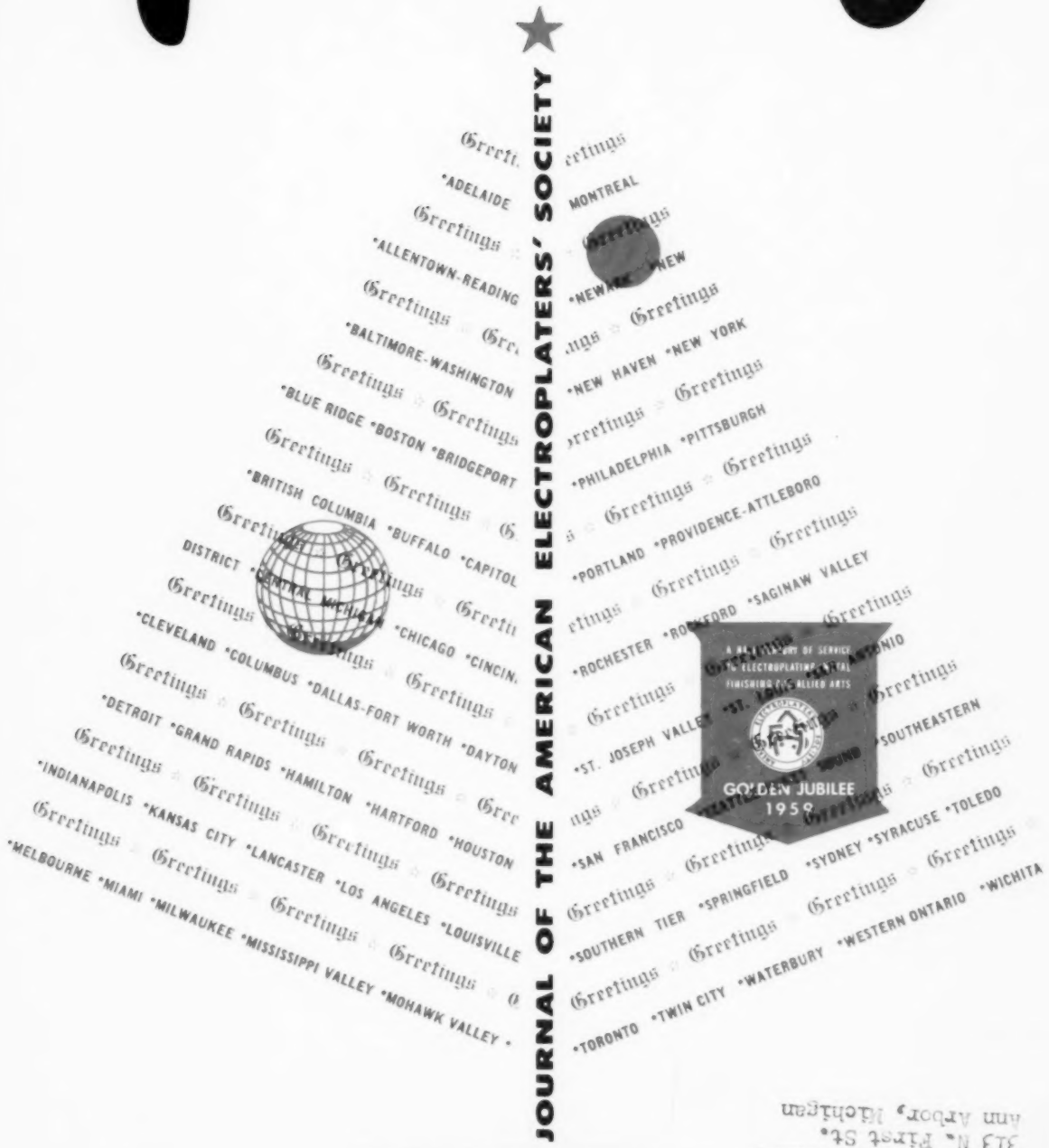
plating

JOURNAL OF THE AMERICAN ELECTROPLATERS' SOCIETY



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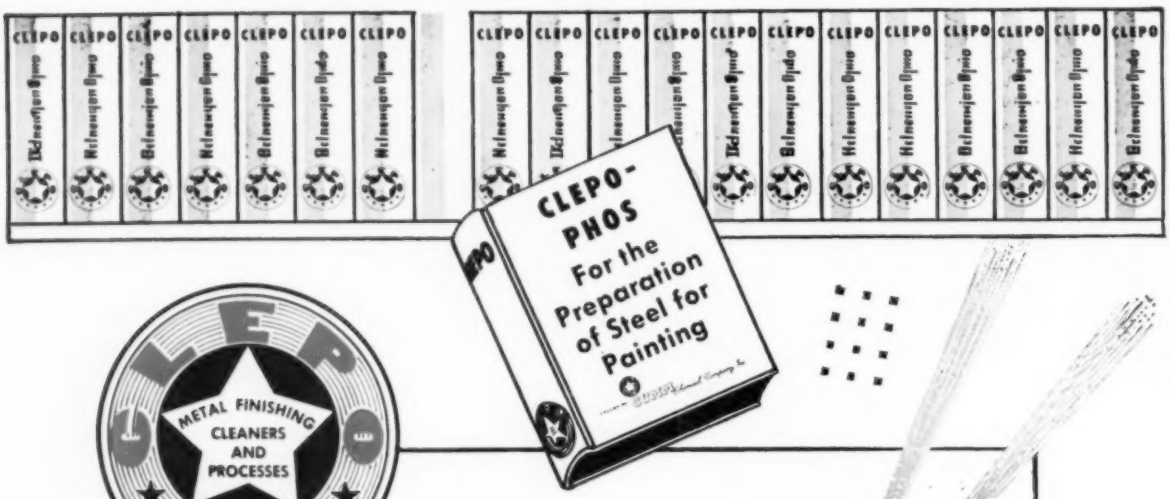

CLEPO
METAL FINISHING CLEANERS AND PROCESSES

Clepo-Phos *Conditions* STEEL WHILE IT CLEANS

Reduces Foaming and Scaling to a Miniumum

CLEPO-PHOS so conditions the surface of the steel to be painted that it will anchor the coating firmly to the surface. Unconditioned surfaces produce poor bond, whereas a CLEPO-PHOS conditioned surface produces a lasting bond with the paint.

While this distinctive conditioning is of paramount importance, other operational values of CLEPO-PHOS should not be overlooked:

1. CLEPO-PHOS has excellent cleaning qualities.
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And CLEPO-PHOS is a 'one operation' formulation. It cleans and conditions simultaneously at exceptionally low cost. You should try CLEPO-PHOS in your production. Order a good workable test sample. Meanwhile discuss your pre-paint cleaning and conditioning problems with our Field Service Man. His experience and knowledge of the problems should be helpful.

• • •

CLEPO-PHOS is only one of many, many chemicals developed by our research staff which combines technical skill and sound, practical knowledge of your industry's requirements. CLEPO stands for technical service as well as for quality products.

FREDERICK

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INDICATE A 1201. ➤

How to make plating upon aluminum an exact science: For many years, hundreds of manufacturers have been using Alumon,® an Enthone process, to prepare aluminum alloys for electroplating. Enthone chemists work out the plating cycles, give in-the-plant assistance. Alumon is an easy process to use and it costs less than ½¢ per square foot of surface plated! Write for literature about this economical and efficient process. Also find out about Etchalume,® Weldal,® and other specialized Enthone compounds for finishing aluminum. Enthone, Inc., 442 Elm Street, New Haven 11, Connecticut.

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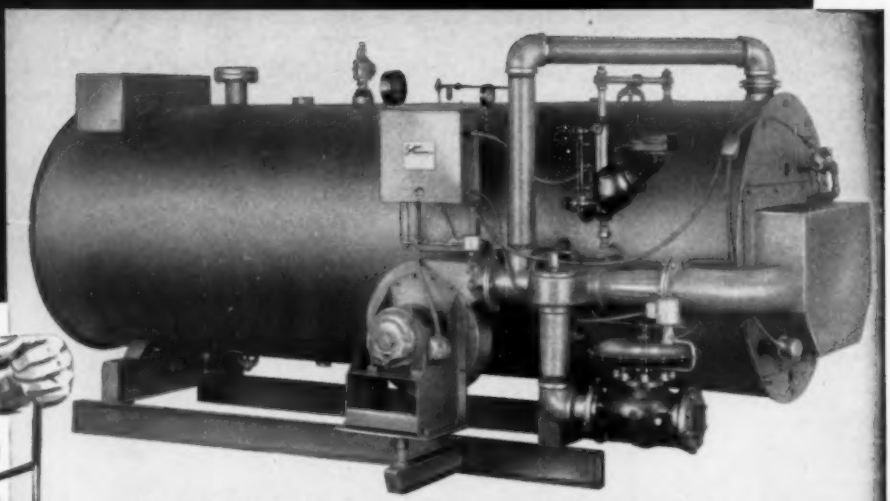

Model 105 Sellers Closed Combustion Chamber Boiler

NOW—No more foul fumes because of incomplete combustion due to back draft through boiler created by exhaust fans or poor draft conditions.

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A HALF CENTURY OF SERVICE TO ELECTROPLATING, METAL FINISHING AND ALLIED ARTS
GOLDEN JUBILEE 1959

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plating

DECEMBER 1958 — AUDITED PAID CIRCULATION ABC — **Vol. 45, No. 12**

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Published by the American Electroplaters' Society, Incorporated, 445 Broad Street, Newark 2, N. J. Phone: HUmboldt 2-3400. Yearly subscription for Members $2.00. Nonmembers U. S. and Canada $5.00. 65c a copy. Foreign, $8.00 a year. $1.00 a copy.
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PLATING is indexed in Applied Science and Technology Index and abstracted regularly in Chemical Abstracts, Metals Review, Metallurgical Abstracts, Engineering Index, Technical Data Digest, and Bulletin Analytique.
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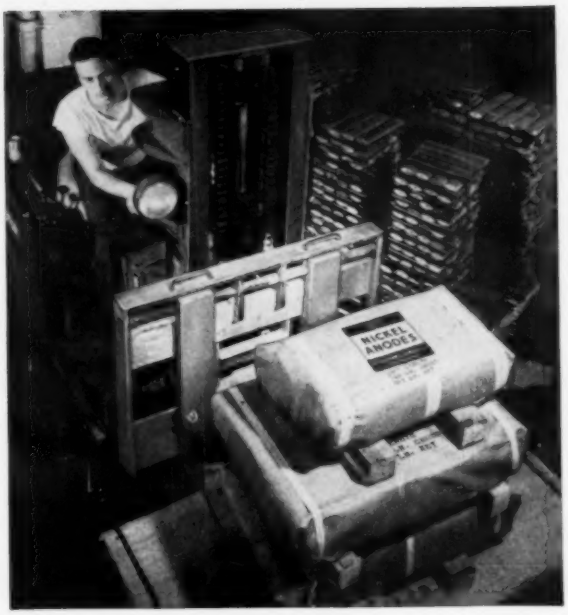
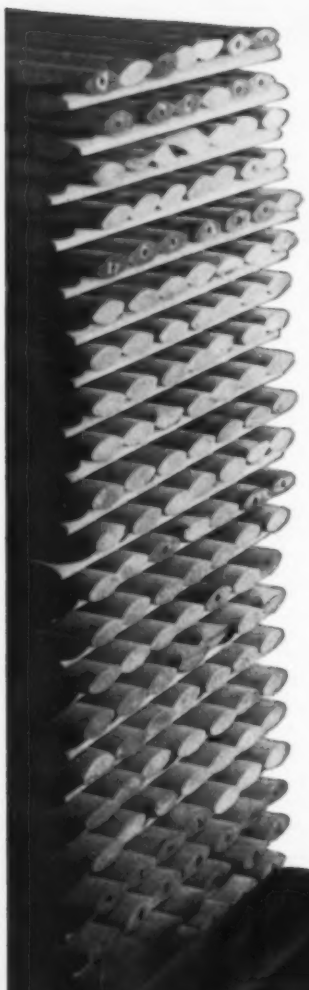
Prompt Delivery of any Quantity

HARSHAW
Nickel Anodes
99+%





HARSHAW XXX CAST CARBON NICKEL ANODES are oval 1½" x 3" in cross section and are available in any length desired. Weight is approximately 1.1 lbs. per linear inch. They are normally used in dull, semi bright and bright nickel plating baths where the pH is 4.5 or lower.

HARSHAW ROLLED OVAL CARBONIZED NICKEL ANODES are 1¼" x 3" in cross section and are available in any length desired. Weight is approximately 1 lb. per linear inch. They are generally used in dull, semi bright and bright nickel plating baths where the pH is 4.5 or lower.

HARSHAW ROLLED OVAL DEPOLARIZED NICKEL ANODES have the same cross section and weight as the rolled oval carbonized nickel anode and are also available in any length desired. These anodes are generally used in nickel plating baths where the pH is 4.0 or higher; they are extremely suitable for such use, as they will corrode well over a wide range of operating conditions.

PACKAGES

Harshaw anodes are wrapped in a fibre reinforced laminated (without asphalt) paper. They are protected from tramp oils, dirt and grease and remain clean until used. The possibility of such contaminents being introduced into the plating solution from anodes is thus kept to a minimum.

Harshaw anodes are shipped in compact packages which feature built-in skids and facilitate quick handling by mechanical or hand trucks. The packages stack easily and quickly. Also, no deposits or returnables are involved with this type of packaging.

Harshaw Nickel Anodes are readily available and prompt shipment of any quantity will be made upon receipt of your order.

Recasting Service

Our foundry facilities are available for recasting nickel anode scrap. Contact your nearest Harshaw Branch for further details.

HARSHAW

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God Rest Ye Merry, Gentlemen

GOLDEN Anniversary marks the arrival of an organization at its half-century milepost and affords it not only occasion for thanksgiving for the rewards of progress but also opportunity to analyze its development and apply the teachings of its yesterday to meet the challenge of its tomorrow.

RESULT of the vision of Charles H. Proctor and a handful of other pioneers who shared his dream, the American Electroplaters' Society (AES) was created a half-century ago (1909) as the National Electro-Platers' Association of the United States and Canada and was transformed to AES shortly thereafter (1913).

ENDURING for five decades to date principally because it has never diverted from the goal of its founding fathers, namely to enrich knowledge and stimulate advancement of electroplating, metal finishing and allied arts, AES has grown step-by-step to its present stage entirely on the basis of service and performance.

EARLY in its life, AES also learned the worth of cooperation and has practiced it in its relations with its members and with its other "publics" that include among others, governmental and educational institutions and agencies; authorities learned in the technical and scientific subjects of AES's essential interest; industrial companies that are its industry's sources of supply.

THE Fiftieth Anniversary that it is currently celebrating through diverse Anniversary activities, will be climaxed not only by its Golden Jubilee Convention and Industrial Finishing Exposition, including its Fifth International Conference on Electrodeposition and Metal Finishing in Detroit, June 15–19, 1959, but also by the Golden Jubilee issue of its PLATING MAGAZINE.

IN KEEPING with its policy of mutuality with its "publics," it hopes that they will share its pride in the advancements fostered commonly in plating and metal finishing and will partake of its Anniversary program, particularly by attending its Convention and International Conference; exhibiting at its Exposition; benefiting from advertising in PLATING MAGAZINE.

NO OCCASION, meantime, provides a happier opportunity than the Christmas period to salute those "publics," especially to express AES's pleasure to its Branches and members, and PLATING's appreciation to its subscribers, for the privilege of serving them.

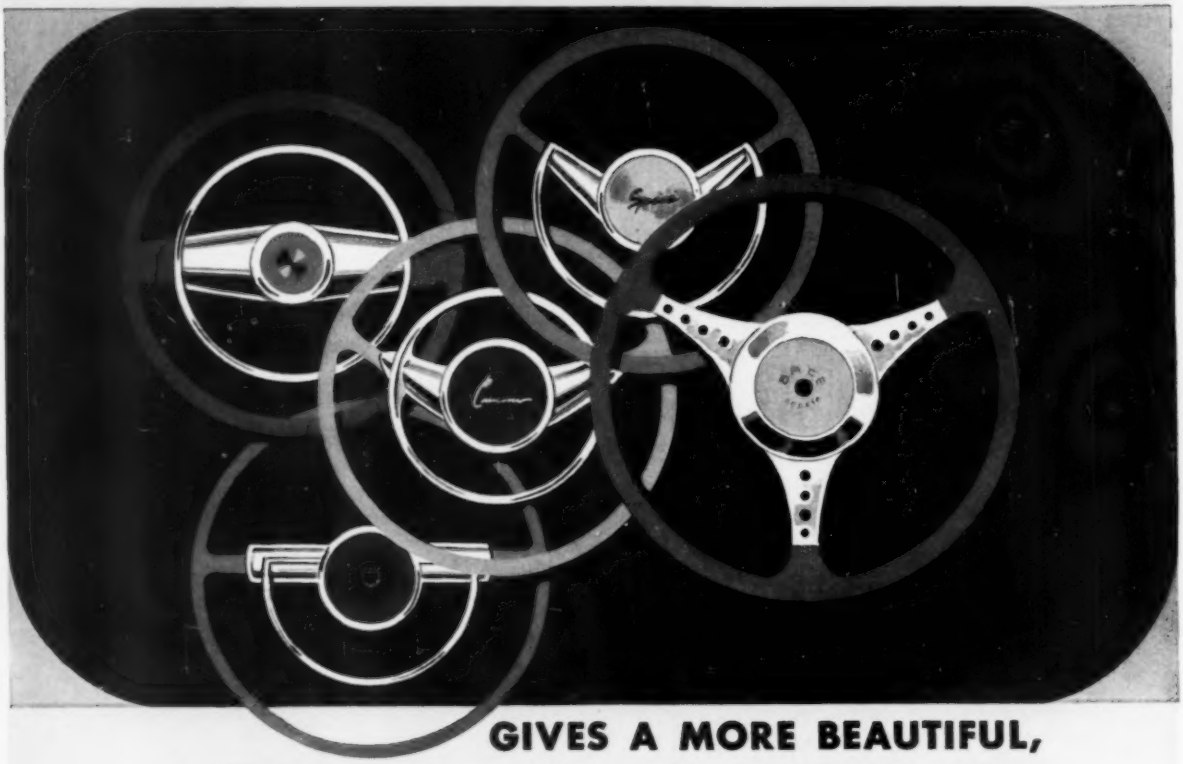
GREATER season than Christmastime does not exist for extending AES's and PLATING's greetings to authors whose works presented at Conventions and in PLATING have enriched knowledge—to companies that, as Sustaining Members, have helped finance AES Research, and as advertisers have employed PLATING's advertising columns—to the Associations and Societies with which AES enjoys most cordial relations—to others with whom AES and PLATING have dealt proudly.

SO TO each of these, best wishes for a Merry Christmas and a rewarding New Year from the Supreme Society, Executive Board and Staff of AES, and from PLATING MAGAZINE, its official journal.

John P. Nichols

Chairman, Editorial Board
and Managing Editor

BRIGHTER COPPER, LESS TIME
with ISO-BRITE™ Addition Agents



GIVES A MORE BEAUTIFUL, DURABLE PLATE AT LESS COST TO YOU!

Whether you're producing plated parts for use on your own products or selling plated parts to volume buyers, your customers' "OK" of your plated finish is of first importance to you! Equally important is being able to do a first-rate job at the lowest possible cost. That's why the proved advantages of ISO-BRITE Copper Process are doubly important.

Now available from Allied Research — ISO-BRITE Copper Gives You:

ECONOMY—Freedom from roughness that reduces scrap. Deposit is fine grained, dense, ductile, and fully bright; requires no buffing. The high anode efficiency and wide operating temperature range, 135-165° F., are bonus qualities.

SPEED—Faster rate of deposit cuts time in tank—or gives you heavier plate for equivalent tank time.

EASE OF CONTROL—Requires less maintenance than any other copper bath. Noted for its high tolerance of organic contamination.

BEAUTY—DURABILITY—Provides fine-grained, dense deposit that assures the finest finish. ISO-BRITE beauty is more than skin deep. No rough, porous copper to try to disguise.

Teamed up with the strong advantages of ISO-BRITE Copper is the systematized approach to your copper plating problem, resulting in a sludge-free bath. This includes bagging using exclusive weaves and materials, containers of vertical wire construction and FLAT-TOP anodes.

We study your problem and make specific recommendations tailored to your installation.

For complete information or assistance, simply get in touch with the Allied Field Engineer, listed under "Plating Supplies" in your classified 'phone directory.

NOTICE: All Wagner Brothers products, facilities, personnel and know-how are now available to you from Allied Research.

Allied Research Products, Inc.

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Wagner

CHEMICAL AND ELECTROCHEMICAL PROCESSES, ANODES, RECTIFIERS, EQUIPMENT AND SUPPLIES FOR METAL FINISHING

This Advertising Opportunity Knocks Once In A Long, Long Time.

PLATING MAGAZINE's parent, American Electroplaters' Society (AES), is currently observing its Fiftieth Anniversary, and the full year's observance, launched July 1, 1958, is gaining momentum from every standpoint.

LED by 50 AES Branches in the United States supplemented by 5 in Canada and 3 in Australia, the Golden Jubilee is targeted for large educational and institutional impact.

AND not only will AES's year-long Fiftieth Anniversary observance be climaxed by its Golden Jubilee Convention and Industrial Finishing Exposition, including the Fifth International Conference on Electrodeposition and Metal Finishing, to be held in Detroit, June 15-19, 1959 with the AES's Detroit Branch as host, but also by PLATING MAGAZINE's Golden Jubilee issue to appear in June 1959.

THIS Golden Jubilee Issue, a unique feature edition, will be beamed both for immediate interest and value to PLATING's global circulation and for long retainment by its readership as an AES reference source and as a memento of the Society's arrival at its half-century milepost of service to electroplating, metal finishing and allied arts.

IMAGINE the arresting power, merchandising strength and remembrance value afforded to company product and institutional advertising by such a unique issue.

NOW is the time to assure yourself of advertising space accommodation, both product and institutional, in that issue because demand looms large, particularly for special, preferred or premium advertising positions.

GIVE our advertising people here the privilege of hearing from you at the earliest possible time as to the extent of advertising space investment that you intend to make in PLATING MAGAZINE's Golden Jubilee Issue. You'll be glad you did!

FOR COMPLETE STORY, write or phone today!
445 Broad Street, Newark 2, New Jersey
Telephone: HUmboldt 2-3400

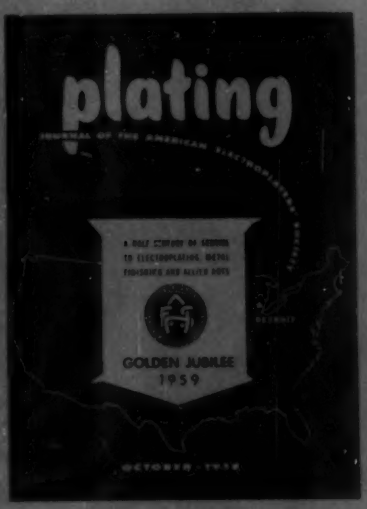
A magazine's subscription renewal percentage is a gauge of the strength and stability of that publication. It is a fact of prime interest and importance to advertising space buyers.

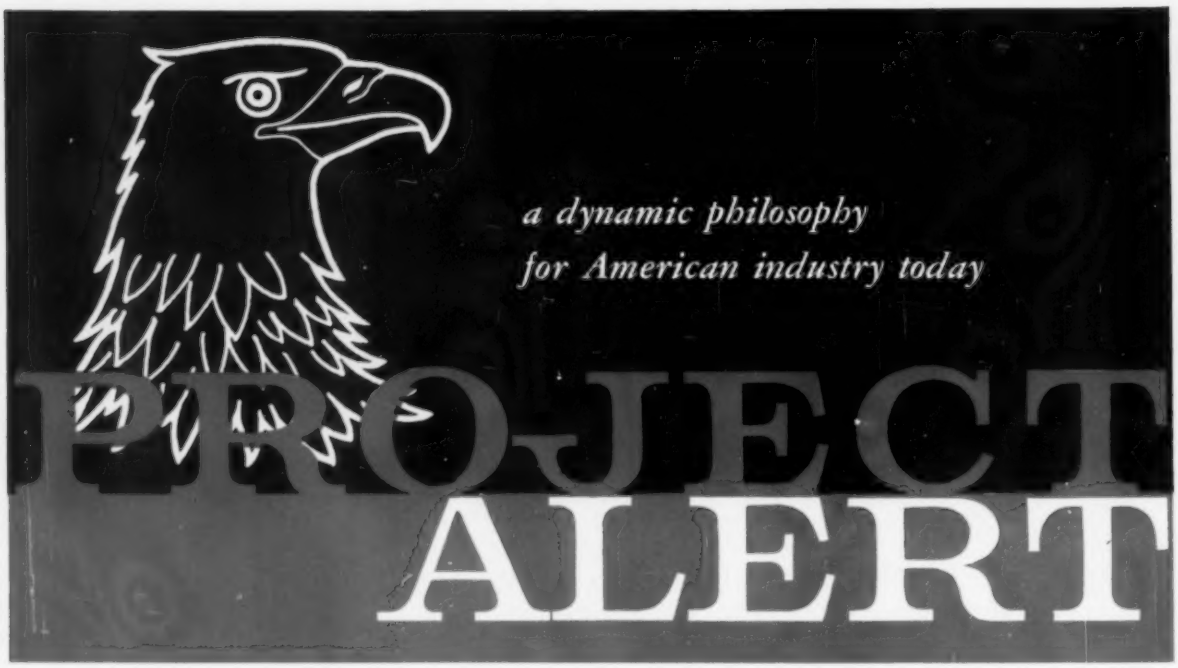
PLATING MAGAZINE is proud of its renewal percentage, reportedly highest among ABC-audited publications in this field.

Of PLATING subscriptions (AES members) that expired during the 12-month period ending October 31, 1957, some 91% or 6520 of 7168 such subscriptions were renewed.

Of PLATING subscriptions (AES non-members) that expired during that same period, over 78% or 851 of 1087 such subscriptions were renewed.

The foregoing data are from the Publisher's Statement of PLATING MAGAZINE for the six-month period ending June 30, 1958, latest available at this date (November 1, 1958).





The purpose of this project is to establish a creative attitude of *dynamic alertness* on the part of all personnel in American industry.

Dynamic alertness is alertness on the move . . . is a positive, constructive way of thinking . . . a spirited new attack on your problems. It is swinging into action to get things done today . . . to insure a brighter, more prosperous future.

Three key words express the attitude of *dynamic alertness* . . .

1. **Observation:** This means inspiring your people to look at your problems with curiosity and creative imagination. It is taking a walk through your plant and looking at things as though you are looking at them for the first time. It is cutting through the fog of complacency and seeing things with new eyes. It is looking for new ways to stop leaks and losses; searching for new ways to speed production and efficiency.

2. **Concentration:** This means the intense application of the mind power of everyone to specific problems. It is the starting of new creative fires in your organization. It is having key people ask themselves key questions: How can I do my job better? How can I speed the flow of work? How can I cut down on errors? It is applying individual and group thinking to a list of things to be done and sticking with them until they are finished. It is preparing today to solve the problems of tomorrow.

3. **Devotion:** This represents a new vital spirit of rededication to your company, to your customers, to your industry, to America. It is a return to the creative ingenuity that made this nation great . . . finding a way or making one. It is having the power and purpose to go forward, to believe in the future, to move ahead to better things.

We at Udylite believe in Project Alert. All of us, to a man, are pledged to a policy of dynamic alertness in every facet of our jobs . . . in our contacts with fellow workers . . . in the handling of equipment . . . on the production line . . . in our contacts with suppliers and customers.

C. H. Reeme, *president*
The Udylite Corporation

the udylite corporation
Detroit 11, Michigan
World's Largest Plating Supplier

Make Project Alert work for you

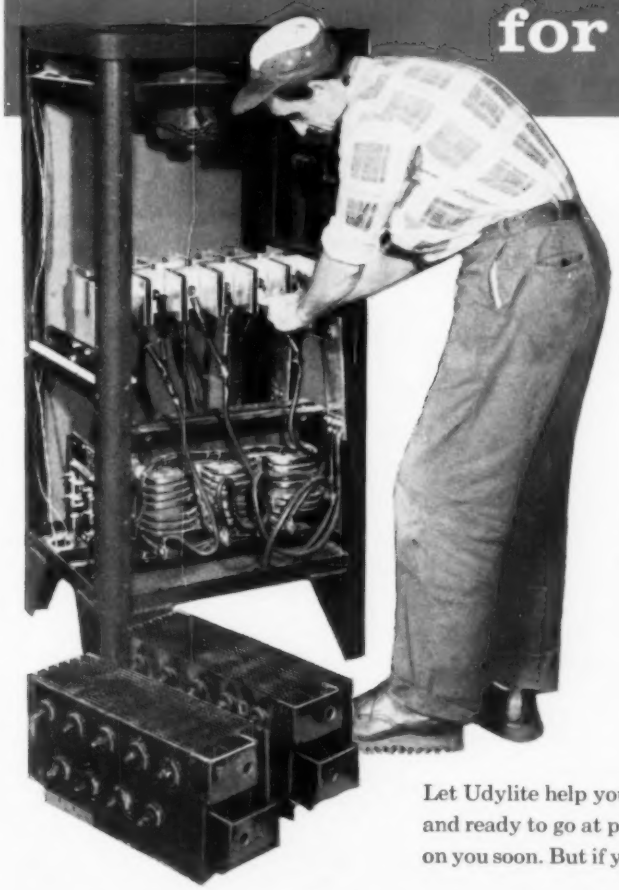
Apply this dynamic philosophy to your firm. New, fresh creative imagination, newer, better production methods, newer more reliable equipment applied to the job *now* . . . will pay off in a brighter, more prosperous tomorrow. Write for a free copy of the Project Alert folder and a free Project Alert lapel button. There's no obligation, of course.

PROJECT ALERT
THE UDYLITE CORPORATION

Project Alert Working at UDYLITE *Produces for You...*

SILICON EFFICIENCY, RUGGEDNESS AND LONG LIFE

for old rectifiers



1. **A SPECIAL PRODUCT** . . . For the first time, a Udylite-engineered, Udylite-built *silicon* replacement stack is offered for you to use in revitalizing your Udylite magnesium-copper-sulphide or selenium rectifier and upgrading its performance to the level of today's best. *And you can do this in your own shop*, without delay, at a minimum of expense and down time.
2. **A SPECIAL SERVICE** . . . As an alternate plan, your old rectifier can be returned to Udylite for *factory* installation of the silicon replacement stacks by trained rectifier specialists. At the same time, your rectifier will be completely overhauled and tested so that it will be returned to you renewed and ready for the longer life and high efficiency of Udylite silicon.
3. **A SPECIAL VALUE** . . . This whole program is set up as a Project Alert. A special department will handle your order and your equipment from start to a completely satisfactory finish. A *guaranteed delivery* will keep your down time to a minimum. With prices based on a production line plan, you will get more value per dollar spent than you ever before thought possible.

Let Udylite help you get your entire plating operation in top working order and ready to go at peak capacity. Your Udylite sales engineer will be calling on you soon. But if you need priority service, write, phone or wire directly to:

the **udylite** corporation

detroit 11, michigan • world's largest plating supplier

PROJECT ALERT

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 1207.

ATOMEX®
IMMERSION GOLD SOLUTION

gives you
4 PLUS FACTORS

1. EXTRA DENSE. Atomex can be used on a wide variety of base metals and has been used for electroplating many different items. It deposits an *extra dense* coat so that the same appearance can be achieved with 30% less gold.

2. UNIFORM DEPOSIT. Since there can be no electrical shielding, there are no low or high density areas — all parts of the object, even blind recesses, receive a *uniform deposit.*

3. EASE OF CONTROL. No *analytical control* of the bath is necessary because there is no free cyanide or carbonate buildup. Small operators no longer will have to hire consultants to check baths.

4. SAVES TIME. All the gold in the bath can be consumed. The spent solution is thrown away, rather than sent back to the manufacturer for refining. *Saves valuable time in many electroplating operations.*

These four major advantages, plus the ease of operation and simple controls make Atomex a valuable adjunct to any electroplating plant.

Investigate **ATOMEX** *for your gold electroplating needs*

ENGELHARD INDUSTRIES, INC.
CHEMICAL DIVISION
113 ASTOR STREET
NEWARK 2, NEW JERSEY

A Timely Message on
Building A Bright Future

That's Me!

by Sox von Liebestraum Sax
Ex Detroit Rep. and Assistant to
Ben P. Sax, Chairman of the Board
American Buff Company

Every dog needs self confidence to build a bright future.

But it takes a sense of security to feel really confident. And dog, oh, dog, have I got security! My "golden" dog-house and fortunate position as super-salesman for the NUMBER ONE buff manufacturer!

Now, as far as I'm concerned . . . with our 7 wonderful Centerless Buffs that increase output as much as 100%, we're ridin' at the head o' the dog sled. But even better'n that . . . good ol' Stan (that's Stan Sax, my assistant) showed me how American Buff intends to *stay* 'way out front. He dug out meaty facts that I can bark back at you . . . with self-confidence.

He showed me how it took four whole years for our chemists, scientists and engineers to develop the one-and-only GOLDEN TREATMENT . . . that makes American Buffs last longer, cut faster, multiply output and slash production costs for *you*. Even a whelp in the industry can sniff out the appeal of a meaty bone like that. But leave it to our scientists. If something even greater can be developed . . . you'll hear of it *first* from American Buff . . . and *me!*

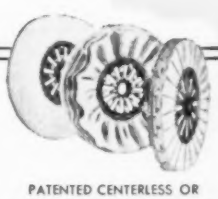
If you'd like to brighten up *your* production picture, call me. We'll get together and I'll show you how.

Cordially,

Sox von Liebestraum Sax

"For the Job that's TOUGH . . . use an AMERICAN BUFF"

World's Largest Manufacturer of Buffs and Polishing Wheels for Every Finishing Operation



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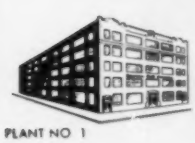

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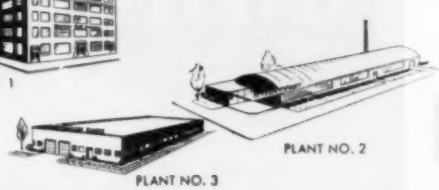


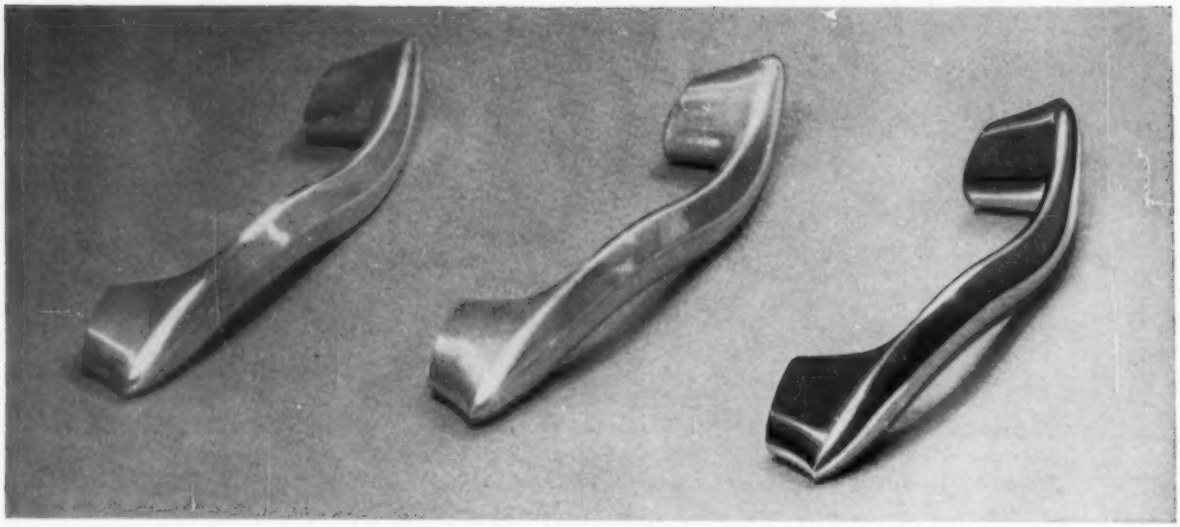
PLANT NO. 2

PLANT NO. 3

American Buff Company

2414 S. LaSalle St., Chicago 16, Illinois • CAlumet 5-1607

AMERICAN BUFFS ARE REGULARLY ADVERTISED IN FORTUNE MAGAZINE



Three stages in the finishing of a zinc base die casting. Casting at left was buffed. Center casting was buffed and electrocleaned in Oakite 195. Casting at right was buffed, electrocleaned in Oakite 195, and plated. Note that center casting retains full buffed lustre and color after its electrocleaning in Oakite 195.

New electrocleaner for zinc die castings assures brighter plate... and cuts rejects!

Plating of zinc base die castings now becomes a more dependable, more economical operation with the introduction of Oakite 195, a *non-etch* anodic cleaner.

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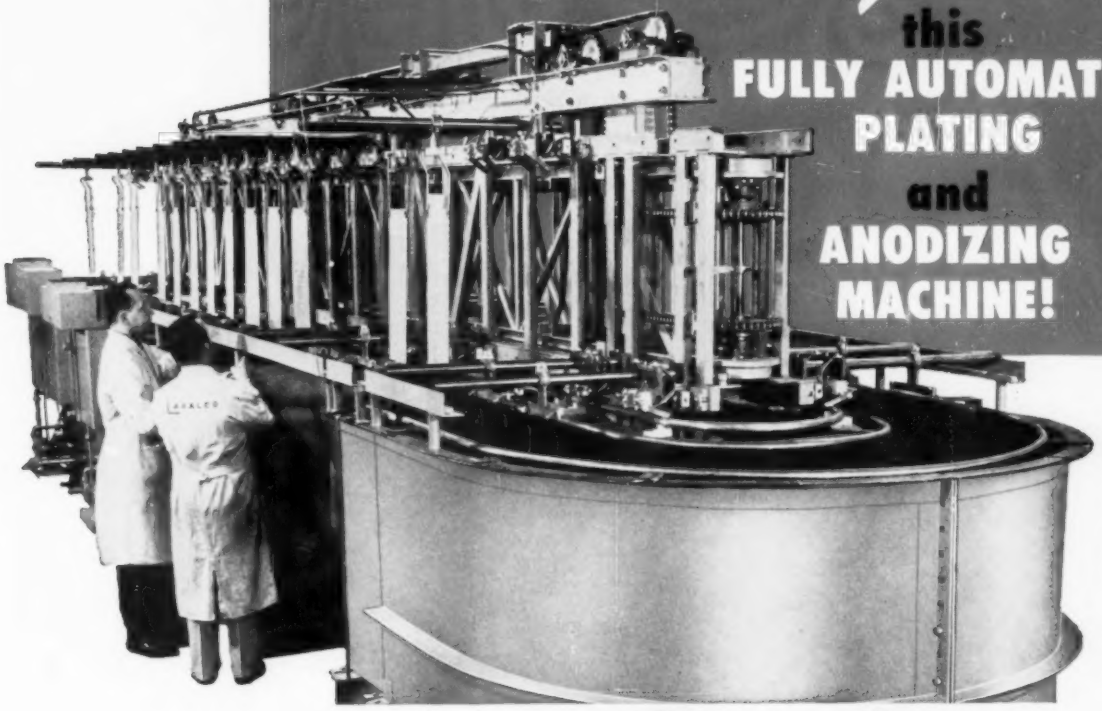

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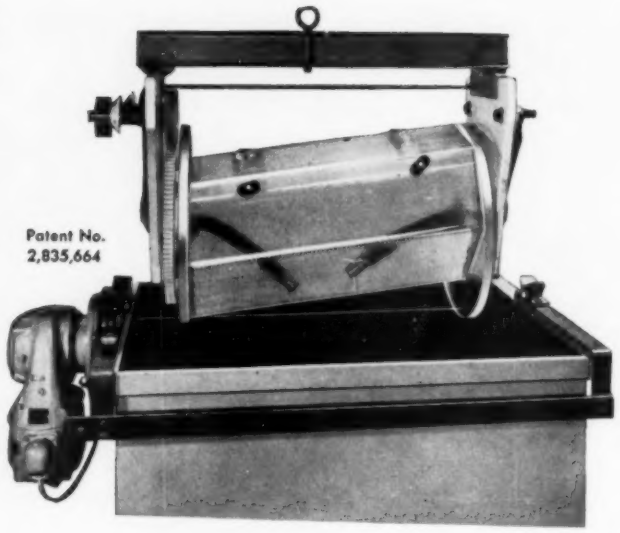

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Uniform Distribution of Plate

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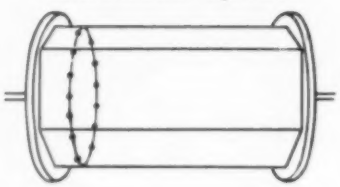
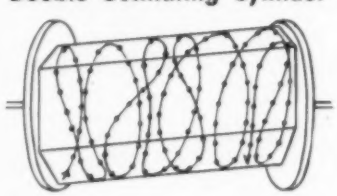


As the cylinder revolves the marked piece follows a fixed path round and round the inside wall.

Double Oscillating Cylinder



The marked piece shows the progressive figure 8 mixing action added by double oscillation. The work pours back and forth as well as round and round.

Individual pieces move from end to end of the cylinder. They roll, twist and turn. None remains buried.

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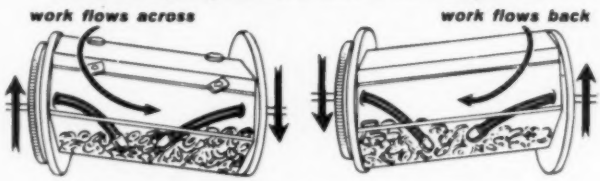

Uniform Distribution of plate produces a specified thickness in less time

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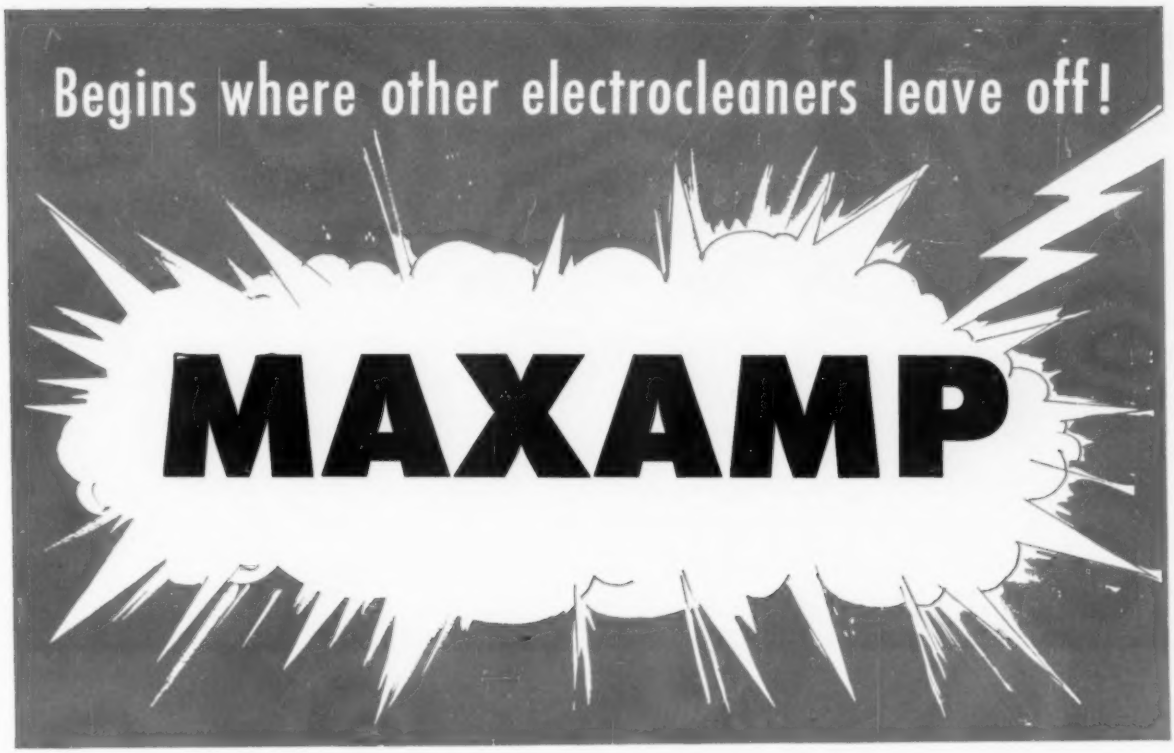

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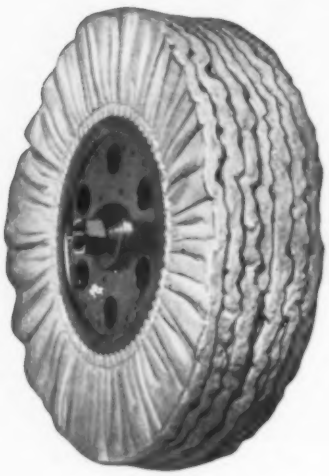

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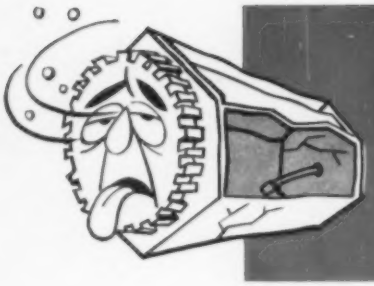

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THE CHEMISTRY OF BRIGHT NICKEL PLATING SOLUTIONS

by EDWARD B. SAUBESTRE*

ABSTRACT

Brighteners in nickel plating solutions fall into two categories: first and second class. The latter make it possible to build mirror-brightness, but yield brittle, stressed deposits of poor appearance, and are intolerant to impurities in the plating solution. These objections are overcome by adding brighteners of the first class as well. The chemical groupings characteristic of the two classes of brighteners are tabulated. The role of leveling agents is mentioned. The importance of cathodic reduction and anodic oxidation of brighteners is stressed with many typical reactions. It is shown how sulfur may appear in the nickel deposit. The reaction of brighteners, and their oxidation-reduction products, with nickel to form various nickel-organic complexes is discussed, and the implications for nickel plating presented. It is also shown how brighteners may affect the acidity of boric acid in the cathode film. The principles of compounding brighteners, and their effect on the properties of bright nickel deposits are summarized.

A PREVIOUS PAPER IN THIS series has discussed the chemistry of Watts nickel plating solutions.[1] Deposits from this type of bath are normally white and matte. For decorative applications, particularly where subsequent chromium plating is to be used, it is necessary to buff the nickel to a high degree of luster after plating. Because of the labor involved, this is often a costly operation. For this reason, interest in bright nickel plating has become very great since 1935. There are several ways of obtaining a bright nickel deposit. Among these are: (a) organic bright nickel baths, (b) leveling nickel baths, (c) nickel alloy baths, (d) PR plating, and (e) electropolishing. These methods have been reviewed previously by the writer.[2]

This article will consider the chemistry of the first two methods, since they are the ones most commonly employed in commercial practice.

I. INORGANIC CONSTITUENTS

These are the same as in a Watts bath, and correspond to those considered previously.[1] However, since most brighteners function best at relatively high current densities, it is necessary to employ relatively high total nickel content, and more chloride (especially in leveling baths) than in dull Watts nickel baths. The boric acid content is correspondingly higher as well. Typical ranges for use with most proprietary bright nickel processes are:

$NiSO_4 \cdot 6H_2O$	250–450 g/l
$NiCl_2 \cdot 6H_2O$	45–75 g/l
H_3BO_3	30–45 g/l
*p*H (electro.)	2.0–4.0
Temp. (°C)	45–70
Current density (asf)	20–100 (30–50 most common)

II. BRIGHTENERS

Proprietary bright nickel baths usually involve two classes of organic brighteners. Those of the first class have two functions: they provide bright plate over a bright substrate (though not able to build luster) and permit the second class of brighteners to be present over an acceptably wide range of concentrations, partly by increasing the tolerance to unavoidable metallic impurities and partly by reducing brittleness and stress in the deposit. Brighteners of the second class are used to build mirror-like luster on platings, but most suffer from the fact that in the absence of brighteners of the first

*Assistant to the Research Director, Enthone, Inc., New Haven, Connecticut.

class they lead to excessive brittleness and stress in the deposit.

A. Brighteners of the First Class

The earliest brighteners of the first class were typified by the Schlotter bath, which used naphthalene disulfonic acids. Later work indicated that brighteners of the first class contain one or preferably more organic groups containing $=C—SO_2—$ in the molecule. Some materials of this type are:

Source of $=C—$	Name
1. Aryl ring	Benzene, naphthalene, etc.
2. Substituted aryl ring	Toluene, xylene, naphthylamine, toluidine, benzyl naphthalene, etc.
3. Alkylene chain	Vinyl, allyl, etc.
Linkage with $—SO_2=$	
1. $—OH$	Sulfonic acid
2. $—ONa$; $—O$ $\diagdown$ Ni $\diagup$ $—O$	Sulfonates
3. $—NH_2$	Sulfonamides
4. $\diagdown$ NH $\diagup$	Sulfonimides
5. $—H$	Sulfinic acid
6. $—R$ (organic radical)	Sulfones

B. Brighteners of the Second Class

The second class, or auxiliary brighteners, are of two distinct types. One type includes salts of the following metals, which are characterized by high hydrogen overvoltage:

	GROUP				
Period	**IIB**	**IIIA**	**IVA**	**VA**	**VIA**
3	—	—	—	—	S
4	Zn	—	—	As	Se
5	Cd	—	(Sn)	(Sb)	Te
6	Hg	Tl	Pb	(Bi)	—

( ) denotes metal not commonly used.

The other type of brightener or the second class includes unsaturated organic compounds, which may be strongly adsorbed on the cathode. Very small amounts of these materials exert a marked change in properties of the deposit. Some typical examples of such brighteners are:

Radical	Type
$C=O$	Carbon monoxide, ketones, aldehydes, carbolic acids, proteins
$C=C$	Alkylenic carboxylic esters, alkylenic aldehydes, aryl aldehydes, sulfonated aryl aldehydes, allyl, vinyl, etc. compounds, coumarin.
$C\equiv C$	Acetylene and derivatives, acetylenic alcohols
$C—N$	Azine, thiazine, and oxazine dyes, triphenyl methane dyes, quinidines, pyrimidines, pyrazoles, indazoles, pyridinium and quinolinium compounds
$C\equiv N$	Ethylene cyanohydrin
$N—C=S$	Thiourea, cyclic thioureides
$N=N$	Azo dyes

C. Leveling Agents

Bright nickel plating solutions of the type discussed above generally yield deposits which do not level well enough to cover polishing scratches in the basis metal. Therefore, interest has developed in modifications which would improve leveling characteristics and yield ductile, mirror-bright deposits. There is no chemical difference between such leveling baths and conventional organic bright nickel baths. The only difference lies in the nature of the deposit obtained. It is likely that within the next few years all organic bright nickel baths will be of the leveling type, and the distinction being presently made will no longer be needed. The earliest approach to leveling was the deposition of a ductile, nearly bright, buffable nickel which could then be readily buffed to the desired finish. Proprietary coumarin-containing baths are of this type. More recently, interest has centered on the direct adaptation of organic bright nickel baths for leveling action. Although many suitable brighteners of the second class will undoubtedly come into use, at present, two other proprietary types predominate in addition to the earlier use of coumarin; (1) acetylenic alcohols and (2) nitrogen-containing ring compounds such as pyridines and quinolines and quaternary compounds such as pyridinium and quinolinium compounds. Such leveling baths are often characterized by poor covering power and, as a result, poor throwing power subsequently. Baths of the coumarin type are superior to other leveling baths in this respect, but inferior in leveling properties.

III. CATHODIC REACTIONS OF BRIGHTENERS

Co-deposition of the brightener is an important feature of the use of brighteners. This co-deposition may involve permanent deposition of the brightener by cathodic reduction, or may involve adsorption of the brightener on the cathode surface. In many cases, it is the cathodically reduced organic product which is adsorbed strongly to the surface. Such adsorption may be either temporary, and followed by desorption, or permanent, followed by occlusion in the deposit. Nickel may act as a catalyst for such cathodic reductions. How such phenomena affect the properties of bright nickel deposits will be taken up later. In this section, the cathodic reduction reactions which could take place will be discussed. The author has adapted some of this material from a book on the subject of electrode reactions of organic materials, recently published by Allen.[3]

A. Reduction of $=C—SO_2—$

Virtually all bright nickel plating solutions contain compounds of the $=C—SO_2—$ type as brighteners of the first class. It is significant that bright nickel deposits from such baths contain spectrographic evidence of sulfur in the deposit. According to Brenner, et al,[4] about 0.03 to 0.08 per cent of sulfur is present in such deposits, largely in the form of the intermetallic compound Ni_3S_2. Wernick[5] has reported as

much as 6 per cent sulfur in such deposits, but currently used proprietary baths probably correspond more closely to Brenner's figures. Presence of Ni_3S_2 in the deposit renders the latter quite brittle, since the intermetallic collects in the form of thin, brittle films around the growing crystal grains of the nickel deposit, preventing good cohesion.

Brown, in his numerous patents on bright nickel baths[9] stresses the role of nickel as a catalyst for reduction of brighteners of the second class, notably reduction of the C=C bond and of various C=N and N=N bonds. He envisages the reduction products of $=C-SO_2-$ brighteners of the first class as poisoning the catalytic effect of nickel, thereby controlling the rate of reduction and adsorption of brighteners of the second class. Thus, control over brightness and the physical properties of the deposit is more readily achieved.

Wetting agents should be considered along with brighteners of the first class, since the former also contain sulfur in the molecule, usually in the form of sulfonates. Wetting agents may particularly enter into cathode reductions, since they have a low interfacial tension between the cathode and the solution, favoring a high concentration of wetting agent at the cathode surface.

There are two basically different ways in which $=C-SO_2-$ may be reduced cathodically. One is a stepwise reduction, leading to mercaptans, which may become occluded in the deposit; the other is desulfonation, which may lead to formation of intermetallics in the deposit.

(1) Mercaptan formation:

$$=C-SO_2-OH + 2H(H_2O)^+ + 2e = =C-SO_2-H + 3H_2O$$
Sulfonate — Sulfinate

$$=C-SO_2-H + 4H(H_2O)^+ + 4e = =C-SH + 6H_2O$$
Sulfinate — Mercaptan

$$=C-SO_2-R + 4H(H_2O)^+ + 4e = =C-S-R + 6H_2O$$
Sulfone — Sulfide

(2) Desulfonation:

$$=C-SO_2-OH + H(H_2O)^+ + 2e = =C-H + HSO_3^- + H_2O$$

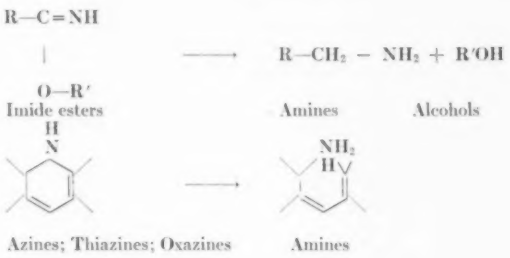
$$2HSO_3^- + 4H(H_2O)^+ + 4e = S_2O_3^- + 7H_2O$$

$$S_2O_3^- + 3Ni^{++} + 6H(H_2O)^+ + 12e = Ni_3S_2 + 9H_2O$$

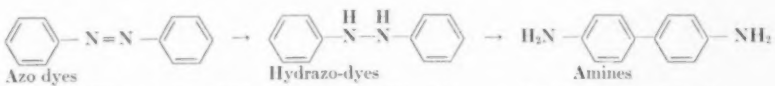
B. Reduction of Nitrogen Compounds

In addition to the $=C-SO_2-$ bond, brighteners of the first class often contain nitrogen in the form of sulfonamide or sulfonimides. Many classes of brighteners of the second class contain nitrogen in a wide variety of forms. Since the usual end product of the reduction of nitrogen compounds is an amine, the sulfonamides and sulfonimides of the first class brighteners do not become reduced at the cathodes, insofar as the nitrogen containing radical is concerned. The sulfonic radical is reduced as pointed out above. Among the brighteners of the second class, the question of cathodic reduction depends on whether the nitrogen is part of a C—N linkage, or of a C=N or C≡N linkage. The former does not normally react at the cathode, but the latter two may be further reduced. When the carbon adjacent to the nitrogen linkage contains O or S linkages, as in amides, urea, thiourea, etc., it is the C=O or C=S bond which is preferentially reduced. In addition to the formation of amines, reduction of nitrogen-containing compounds at the cathode may lead to splitting of the organic compound or to molecular rearrangement. Examples of reductions are given in Table IB.

In addition to straightforward reductions, cathodic reduction may cause splitting of molecules. For example:



Additionally, molecules may be rearranged by cathodic reduction. For example:



$$R-CO-NH_2 \rightarrow R-CH(OH)-NH_2 + R-CO-NH_2 \rightarrow R-CH_2-NH-CH_2-R$$
Amide — Hydroxyamide (unstable) — Amine

C. Reduction of Oxygen Compounds

Compounds containing the C=O group generally are reduced in stages from carboxylic acids, to aldehydes, to alcohols, to hydrocarbons. Esters are the exception, in that they are reduced directly to ethers, the ethers in turn hydrolyzing to the corresponding alcohols (see Table IC).

D. Hydrogenation

All organic brighteners of the second class contain unsaturated organics as an integral part of the brightener molecule. Part of the reason for this is the ease of reduction of such compounds at cathodes. The usual mechanism of cathodic reduction is the conversion of the unsaturated compound into a saturated one, though other specific reactions may occur as well. The reduction of unsaturated compounds probably is intimately associated with the need for organic brighteners to adsorb to the surface long enough to alter the crystal growth habit of the deposit, yet not to adsorb permanently in such a manner as to lead to poor adhesion or cohesion of nickel deposits.

The ease of reduction of C=C bonds in alkyl compounds is shown by the fact that when the C=O and C=N linkages are also present, it is the C=C bond which is reduced. In aryl rings, the C=C bond is much more stable, and reduction occurs generally only when other easily reducible groups are not present. Examples are given in Table ID.

E. Dehalogenation

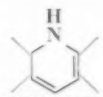
Normally, halogenated organics are not added to the bath, as their presence is usually deleterious. However, they may be produced while the bath is in use by anodic oxidation. They may in part be removed by cathodic reduction (see Table IE).

IV. ANODIC REACTIONS OF BRIGHTENERS

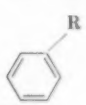
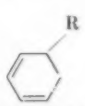
The reactions of most interest are those taking place at the cathode, since they are the ones which affect the appearance of

TABLE I

CATHODIC REDUCTIONS

Reactant		Reduction Product	
Name	**Functional Group**	**Name**	**Functional Group**
A. Sulfur Compounds			
See Text			
B. Nitrogen Compounds			
1. Nitriles	$-C\equiv N$	Imines	$-CH=NH$
2. Imines	$-CH=NH$	Amines	$-CH_2-NH_2$
3. Amides, imides	$-CO-NH-$	Amines	$-CH_2-NH-$
4. Urea; ureides*	$-NH-CO-NH$	Amines	$-NH-CH_2-NH-$
5. Thiourea; thioureides	$-NH-CS-NH-$	Mercaptans	$-NH-CH(SH)-NH-$
6. Pyrimidines; quinidines; pyrazoles; indazoles		Azines	
7. Azo-compounds	$-N=N-$	Hydrazo-compounds	$-NH-NH-$

* The C-O group in urea and ureides is more stable than that in imides and amides, and will not be reduced if other reducible groups are present.

C. Oxygen Compounds			
1. Acid	$-CO-OH$	Aldehyde	$-CHO$
2. Aldehyde	$-CHO$	Glycol(diol)	$-CH(OH)-CH(OH)-$
3. Glycol(diol)	$-CH(OH)-CH(OH)-$	Alcohol	$-CH_2OH$
4. Ketone	$-CO-$	Pinacol	$-C(OH)-C(OH)-$
5. Pinacol	$-C(OH)-C(OH)-$	Alcohol	$-CH(OH)-$
6. Ester	$-CO-OR$	Ether	$-CH_2-OR$
7. Ether	$-CH_2-OR$	Alcohols	$-CH_2OH + ROH$
8. Alcohol	$-CH_2-OH$	Hydrocarbon	$-CH_3$
D. Hydrogenation			
1. Acetylenics	$-C\equiv CH$	Olefins	$-CH=CH_2$
2. Olefins	$-CH=CH-$	Paraffins	$-CH_2-CH_2-$
3. Unsaturated ketone	$-CH=CH-CO-$	Saturated ketone	$-CH_2-CH_2-CO-$
4. Unsaturated amide	$-CH=CH-CO-NH-$	Saturated amide	$-CH_2-CH_2-CO-NH-$
5. Aryl ring		Reduced ring*	
6. Acetylenics	$-C\equiv CH$	Aldehyde**	$-CH_2-CHO$

*If R contains no reducible groupings.
**In sulfuric acid solutions, when certain metal catalysts are present.

E. Dehalogenation			
1. Trihalo compound	$-C-Cl_3$	Dihalo compound	$-CH-Cl_2$
2. Dihalo compound	$-CH-Cl_2$	Halo compound	$-CH_2-Cl$
3. Halo compound	$-CH_2-Cl$	Hydrocarbon	$-CH_3$
4. Trihalo compound	$-C-Cl_3$	Unsaturated dihalo	$=C-Cl_2$
5. Aryl trihalo compound	$Ar-C-Cl_3$	Unsaturated diaryl compound	$Ar-CH=CH-Ar$

the deposit most markedly. Anodic oxidation reactions are of some interest, however, in that they account for decomposition of brighteners, and the oxidation products may diffuse to the cathode, where they may have deleterious effects. Some of the best studied, and most interesting anodic oxidations involve organic acids. However, since these are not used in bright nickel baths (with the exception of formic acid), they will not be discussed.

A. Oxidation of Sulfur-Containing Compounds

The most common group of compounds of this type found in nickel baths are the first class brighteners, which do not react at the anode. However, some other types of sulfur-containing compounds are capable of anodic oxidation, as shown in Table IIA.

B. Oxidation of Nitrogen-Containing Compounds

Not too much work has been done on the oxidation of such compounds, but the oxidation probably proceeds from amines to imines to azo compounds (see Table IIB).

C. Oxidation of Oxygen-Containing Compounds

In general, these are oxidized step-wise from alcohols to acids, and represent the inverse sequence of steps involved in cathodic reduction of such compounds (see Table IIC).

D. Oxidation of Aromatic Compounds

Aromatic compounds are quite readily oxidized at the anode, and since such compounds are usually present in bright nickel plating solutions, their oxidation is of some practical interest. The oxidation of unsubstituted aryl compounds (such as benzene) proceeds by addition of hydroxide groups to the aryl ring. Eventually, these lead to degradation products, consisting largely of unsaturated dicarboxylic acids. Substituted aryl compounds (such as toluene) may oxidize exactly as above, but in addition, the substituent may also oxidize. Sometimes, both types of oxidation will occur, i. e., toluene will be oxidized to cresol (addition of —OH to the aryl ring), and the latter will be oxidized to quinone (oxidation of the $—CH_3$ substituent group). Three-ringed compounds, such as anthracene, and two-ringed compounds, such as naphthalenes, oxidize much as the above, that is, hydroxide groups add on to the ring, and

TABLE II
ANODIC OXIDATIONS

Reactant		Oxidation Product	
Name	**Functional Group**	**Name**	**Functional Group**
	A. Sulfur Compounds		
1. Mercaptans	R—SH	Sulfides	R—S—S—R
2. Thiocyanates	—SCN	Sulfonates	$—SO_3—OH$
3. Thiourea; thioureides	$—NH—CS—NH_2$	Sulfides	—NH—C(=NH)—S—S—C(=NH)—NH—
	B. Nitrogen Compounds		
1. Amines	$—NH_2$	Imines	=NH
2. Imines	R=NH	Hydrazo compounds	R—NH—NH—R
3. Hydrazo compounds	R—NH—NH—R	Azo compounds	R—N=N—R
	C. Oxygen Compounds		
1. Alcohols	$—CH_2—OH$	Aldehydes	—CHO
2. Aldehydes	—CHO	Acids	—CO—OH
3. Ketones	$R—CO—CH_2—R'$	Acids	R—COOH + R′ COOH
	D. Aromatic Compounds		
1. Benzene	Ar	Phenol	Ar—OH
2. Phenol	Ar—OH	Catechol; hydroquinone	HO—Ar—OH
3. Hydroquinone	HO—Ar—OH	Quinone	O=Ar=O
4. Quinone	O=Ar=O	Maleicacid	HOOC—CH=CH—COOH
5. Toluene	$Ar—CH_3$	Cresol (and other hydroxy compounds)	$HO—Ar—CH_3$
6. Toluene	$Ar—CH_3$	Benzaldehyde	Ar—CHO
7. Cresol	$HO—Ar—CH_3$	Quinone	$O=Ar=O+CO_2$
8. Benzaldehyde	Ar—CHO	Benzoic acid	Ar—COOH
	E. Halogenation		
1. Paraffinic hydrocarbon	R—H	Halo-compound	R—Cl
2. Olefin	R—CH=CH—R	Halohydrin	R—CH(OH)—CH(Cl)—R

substituents may also oxidize. See Table IID for further examples.

E. Halogenation

One of the more serious effects of anodic oxidation is the tendency for halogenation to take place at the anode. Since most halogenated organic compounds are unsuitable as brighteners, this imposes a limitation on the choice of brightener agents, especially in high chloride baths. It should be noted, though, that halogenated compounds are not always deleterious, and some organic brighteners are deliberately halogenated.

Anodic halogenation can take place in two ways: by direct substitution of halogen for a hydrogen in the organic compound structure, or by saturation of unsaturated compounds. Examples are given of these two types of reactions in Table IIE.

V. ORGANO-NICKEL COMPOUNDS AND COMPLEXES

In discussing the effect of organic brighteners on nickel plating, usual emphasis is on the adsorption and desorption of the addition agent, and the effect which this has on the deposition potential of nickel and overvoltage from one point on the surface to another. Another possibility which has not been explored as extensively is that of compound or complex formation between nickel ions and the organic addition agent, although brighteners have at times been sold in the form of concentrates of complex nickel compounds.

Many of the organic compounds found in bright nickel plating solutions are capable of reacting with nickel ion. Such reactions could affect nickel deposition in two ways: (a) the resulting complex could greatly change the deposition potential of nickel (as discussed in a previous article in this series dealing with alkaline nickel plating solutions;[6] (b) the size of the organic nickel complex could greatly affect the kinetics of nickel deposition because of spatial considerations, i. e., the relatively large size of most organic nickel complexes could hinder the deposition of the nickel ion, and thus affect what is the rate governing step in the kinetics of nickel deposition.

A. Types of Organic Nickel Compounds

Three types of organic nickel compounds may be distinguished; (a) organo-metallic compounds, (b) esters, and (c) organic coordination complexes. The first type, organo-metallic compounds, refers to compounds in which there is a direct bond between nickel and carbon. In this respect, fortunately, the problem in bright nickel plating is simplified by the fact that, according to Rochow et al,[7] nickel forms singularly few organo-metallic compounds. Only two types are known; one of them, the cyclopentadienyl compounds, is not found in nickel plating solutions. The other type, the isonitriles, is not added to nickel plating solutions directly, but might arise from isomerization of nitriles, such as those used in some leveling baths:

$$\underset{\text{Nitrile}}{R{-}C{\equiv}N} \;=\; \underset{\text{Isonitrile}}{R{-}N{-}C>}$$

According to Hieber et al,[8] such isonitrile compounds with nickel are very stable. The second type of nickel compound, esters, is of no importance, first because organic acids required to form esters are not usually present in nickel plating solutions, and secondly because even if present, the dissociation of esters is sufficient to minimize the effect of such componds on the potential of nickel deposition or on the kinetics of its deposition. This leaves the third type of organic nickel reaction, the formation of coordination complexes, which will now be considered further. Nickel coordination complexes are of importance in determining the conditions of nickel deposition. Many years ago, Swann et al[9] showed that coordination complexes affect nickel deposition in two ways: (a) by altering the deposition potential, poorest quality deposits being obtained in acid baths from complexes that are either very easily reduced, or reduced only with extreme difficulty and (b) by spatially interfering with deposition, large coordinate groups such as the aryl groups, leading to poor quality deposits.

Before considering some nickel coordination compounds, it might be well to define coordination compounds. For our purposes, we may consider coordination compounds or complexes as consisting of bonds between an acceptor ion, which is willing to accept a share in a pair of electrons, and a donor, which is willing to donate an electron to produce the shared pair of electrons. The donor may be a simple or complex ion, or a neutral molecule. In general, the metallic ion acts as the acceptor, and the organic radical acts as the donor. Transition metals, such as nickel, show a very decided tendency to be acceptors. Since most organic compounds of the type found in bright nickel plating solutions contain several types of atoms, such as C,H,O,N, and S, it is of importance to rank the relative donor tendencies of the various atoms. The relative donor tendency depends in large measure on the acceptor present. In the case of nickel, one of the strongest donor atoms is nitrogen, with sulfur the next most important donor. Oxygen is a relatively weak donor for nickel, while carbon, as mentioned above in connection with organo-metallic compounds, shows almost no tendency to coordinate with nickel. Chloride and phosphorus compounds are also donors for nickel. Chloride complexes were considered in an earlier paper in this series,[1] while phosphorus compounds are not generally present in nickel plating solutions.

B. Coordination Compounds with Nitrogen

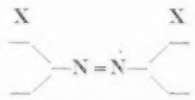
Nitrogen is a strong donor for nickel ions, and many coordination compounds with nickel are known. Amines, many of which are used in bright nickel solutions, form coordination compounds, especially when present in aliphatic compounds. Aryl, or ring compounds, have much less tendency to form coordination compounds through the amino group. Examples of such complexes include ethylenediamine, diethylenetriamine, and triethylenetetramine. Longer chain amines, such as propylene and butylene amines, interfere with nickel deposition, because of their size.[9] Nitriles, such as those present in some leveling baths, are fairly strong donors for heavy metals, but do not form known stable coordination complexes with nickel. However, it is possible that compounds such as ethylene cyanohydrin form coordination compiexes with nickel.

Oximes and nitro compounds form many well known and very stable complexes with nickel, such as in the analytical use of dimethylglyoxime. However, with the exception of one or two patents, there is little mention of such compounds in nickel plating solutions, so that coordination compounds of this type are probably not of importance.

The imine group, $R_2C{=}NH$ can form coordination complexes, the most stable and best studied of which are the biguanide compounds.[10] Some of these compounds form extremely stable complexes with nickel. Such complexes are of importance in view of the common occurrence of the $C{=}NH$

bond in organic brighteners in nickel plating baths. This might also be of interest in brighteners of the first class containing sulfonamides and sulfonimides.

Another common class of organic brighteners in nickel plating consists of those containing nitrogen in aryl, or ring, compounds. Among these are the azo dyes, which have a pronounced tendency to act as donors for nickel.[11] This is especially true of azo dyes containing —OH, or $-NH_2$ in the ortho—position:



For reasons of solubility, as well as because of their action as first class brighteners, sulfonic acid radicals, $-SO_2-OH$ are generally added to aryl compounds in bright nickel plating solutions. In this connection, it is interesting to note that experiments performed on sulfonate-containing azo dyes indicate[12] that the substituent group enhances the donor properties of the azo group. Other ring compounds containing nitrogen, such as pyrazoles, pyrroles, and pyridines show coordinating properties with nickel due to the donor tendencies of nitrogen.[13, 14, 15]

C. Coordination Compounds with Sulfur

After nitrogen, sulfur shows the next greatest tendency to act as a donor towards nickel. Sulfonates, as such, do not posess donor tendencies, but as pointed out previously, sulfonates tend to be reduced at the cahtode to, among other things, thiosulfates, mercaptans, and organic sulfides. All of those show coordination properties due to the donor action of S.

Thiosulfate, $S_2O_3^=$, is of particular interest, with reference to the codeposition of sulfur in bright nickel deposits. Thiosulfate contains unshared electrons on both oxygen and sulfur atoms, and both may contribute to formation of coordination complexes with nickel.[16, 17] The stability of the nickel coordination compound with thiosulfate is attested by the fact that if nickel is plated from a Watts bath containing excess thiosulfate, the deposit contains 20–70 per cent sulfur, present as an intermetallic compound.[18] This offers an explanation of the comments offered in III A above on the appearance of sulfur in bright nickel deposits, and offers also a mechanism for helping to explain the brittleness of such deposits.

In addition to thiosulfates, organic sulfides coordinate readily with nickel.[19] The same is true of thioethers,[20] which may be formed as shown above in III A and IV B, and mercaptans.

The thiocarbonyl bond, C=S, is found in bright nickel baths in the form of thiourea, or cyclic thioureides. The sulfur in this bond shows very strong donor tendencies. In fact, in thiourea, $H_2N-CS-NH_2$, which contains both N and S, coordination with nickel occurs primarily through the sulfur.[21] Other C=S compounds, such as thiosemicarbazide, guanyl thiourea, and thiazone, also form stable complexes with nickel.[22, 23] In fact, Bahr and Hess[24] found that in acid solutions containing thiazone, nickel dissociates entirely as $Ni(thiazone)^{++}$.

Aryl ring compounds containing sulfur may also coordinate with nickel, though less is known about these sulfur compounds. Thionyl compounds,[25] thiazine dyes, and mercaptazo dyes[26] coordinate with nickel.

D. Coordination Compounds with Oxygen

Oxygen is a relatively weak donor for nickel coordination. However, some coordination compounds are known involving the bond between nickel and oxygen. As pointed out in III C, reduction of aldehydes and ketones, which are commonly present in bright nickel baths, leads to formation of di-alcohols, or glycols. Such compounds coordinate with nickel[27] through the two adjacent hydroxyl groups. As pointed out in IV C above, oxidation at the anode of aryl compounds can lead to formation of di-alcohols, such as catechol. The latter also form quite stable coordination compounds with nickel.[28]

Organic acids and esters are not normally present in bright nickel baths, but an exception is formic acid. The latter can coordinate with nickel through the C=O bond.[21] Alcohols, ethers, and carbonyl bonds in general do not form any coordination compounds of interest.

Some aryl compounds, such as alizarin, quinoids, hydroxyanthraquinone, etc. may show some tendency to form coordination linkages with nickel.[11]

E. Coordination Compounds with Arsenic

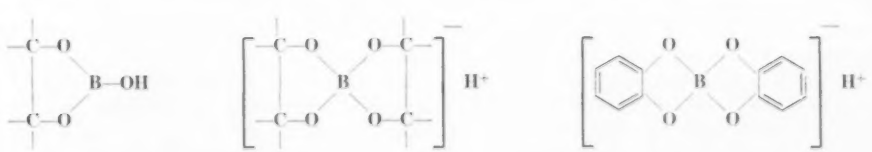
Nickel chloride forms a well defined coordination compound with diarsine.[29] The latter in turn might be formed in the cathode film in the case of those brighteners which contain arsenic as a second class brightener. The same might also be true of lead-containing brighteners.

VI. ORGANIC-BORATE COMPLEXES

In a previous article in this series[1] it was pointed out that boric acid is not a simple compound in nickel plating solutions, but forms a variety of polymeric compounds, some of which can complex the nickel ion. Likewise, boric acid can react with some organic compounds, notably the polyhydric alcohols, β-diketones, α-dihydroxy aryl compounds, and α-hydroxy aryl acids. Both monochelate and dichelate bonds are formed, through a boron-oxygen bond. The existence of the following types of structure has been confirmed.[30, 31, 32]

The three structures at the bottom of the page lead to a decrease in the firmness of the acidic hydrogen bond normally found in boric acid. Thus, the presence of such chelate rings converts boric acid into a relatively stronger acid. For example, Kolthoff[33] gives the equilibrium constant for boric acid dissociation as 2.7×10^{-7} in the presence of glycerine, as compared to 6.0×10^{-10} in its absence.

The particular organic compounds capable of chelating with boric acid are not commonly added to nickel baths as brighteners, but some of the oxidation-reduction products of com-



monly used brighteners are included in the above list. For example, aldehydes and ketones reduce at the cathode to polyhydric alcohols as intermediate products. Such compounds, adsorbed on the cathode surface, could become stabilized by chelating with borate, and thereby lower the localized *p*H at the cathode surface. Similarly, at the anode, aryl brighteners can oxidize to form α-dihydroxy aryl compounds and α-hydroxy aryl acids, which could also stabilize by forming chelate rings with boric acid. The possibility of such complexes affecting the *p*H of the cathode film while nickel is being deposited has not been reported on in the literature.

VII. COMPOUNDING OF BRIGHTENERS

From all of the preceding information, it should be quite apparent that the compounding of a brightener is not a simple matter. By and large, the compounding of such materials has become a highly specialized art, practiced by plating supply houses who sell proprietary formulations suitable for use in bright nickel baths. Therefore, this section will deal only with some generalities to illustrate the types of considerations involved, without giving any specific recommendations.

Use of brighteners of the first class alone will, in general, not give deposits bright enough to be used as such without supplementary buffing. Many of the brighteners of the second class are inherently capable of yielding mirror-bright deposits, but lead to deposits which are highly stressed in tension, and quite brittle. Furthermore, the deposits may be of poor appearance in the absence of brighteners of the first class, and the baths may have low tolerance to metallic and other impurities. Brighteners of the first class generally improve bath tolerance to such impurities, and lead to less brittleness in the deposit. It is not known why brighteners of the first class improve tolerance of the bath to metallic impurities. Sulfonates, of themselves, do not react with metallic ions. However, the cathodic reduction products of first class brighteners have marked donor properties, notably mercaptans and thiosulfate. Perhaps the thiosulfate formed in situ at the cathode coordinates with metallic impurities, thus interfering with their effect at the cathode.

Deposits from baths containing only brighteners of the first class tend to show compressive stress. Thus, by suitable compounding of brighteners, it is possible to offset the tensile stress produced by brighteners of the second class by the compressive stress produced by brighteners of the first class. Thus, most well formulated proprietary brighteners lead to deposits of quite low stress, usually slightly on the tensile side. No matter how the brighteners are compounded, however, the deposits remain hard, and show a tendency to be brittle.

It is possible to combine the primary groups of both a first and second class brightener in one molecule. For example, sulfonated aldehydes contain both the $=C-SO_2-$ group of brighteners of the first class and the $C=O$ group of brighteners of the second class. Other examples are the use of sulfonated alkylenic compounds. Experience indicates, however, that such binary materials function best if additional brighteners of the first class are also present.

It also follows from the earlier discussion that not only the properties of the brighteners themselves must be considered, but also the properties of their oxidation-reduction reaction products. Such products, particularly reduction products formed at the cathode, have a very important role in determining the properties of the deposit. As discussed above, Brown, in his various patents, has also stressed the importance of the cathodic reduction products of sulfonates and their derivatives in controlling the catalytic effect of nickel upon the reduction of other brightener materials.

Finally, the complexing or coordinating tendencies of the brighteners and their oxidation-reduction products must be taken into account in determining the effect of brighteners on the properties of nickel deposits. Probably a great deal more remains to be done in this field.

The problem is rendered more complex by the fact that, whereas we have considered only the active group, $=C-SO_2-$, $C=N$, $C=O$, etc., the structure of the particular organic compound used determines the effectiveness of the active group. For example, the nature of the organic molecule, and the placing of substituent groups and of active groups on the molecule affects the solubility of the compound, the nature of the reduction products formed at the cathode, and determines the relative effectiveness of the active group as a brightener. Also, it must be considered that the brightener or its reduction products must not yield residues which might adsorb so strongly to the cathode surface as to cause exfoliation (peeling) of the deposit, or to cause impaired corrosion resistance.

VIII. PROPERTIES OF THE DEPOSIT

As a class, organic bright nickel baths tend to yield very hard, brittle deposits of high tensile strength. They may be quite stressed, but in most proprietary baths, the various addition agents tend to cancel out each others effect, so that deposits of low stress are often obtained. Purity of the deposit is not comparable to that of a Watts deposit, judging from higher resistivity values. Reduction products of organic brighteners such as carbon, nitrogen, and sulfur, are often present. Grain size is very small, and usually randomly oriented, with no evidence of columnar growth. Often the deposits possess a laminar structure of alternating layers. The deposits are highly lustrous and often possess leveling properties.

Brenner et al[34] found a pronounced correlation between physical properties of nickel deposits and the x-ray structure of the deposit. Whether the foreign matter so detected is codeposited by electrochemical reduction, or by adsorption alone is a matter of conjecture. In the case of organic bright nickel baths, adsorption of the brightener is probably the more important mechanism. While this might imply that there is a close relationship between structure and physical properties, the relationship is not perfect. Thus, Read and Weil[35] found no correlation between hardness and crystal size over small ranges of differences. Stress, likewise, does not lend itself to a simple correlation with structure, though stress tends to be higher in deposits from baths which yield small grain size, such as bright baths. Organic addition agents can have a very pronounced effect on stress, either increasing it or decreasing it. Brenner found that most proprietary baths reduce stress to very low values.[34] Many organic and inorganic brighteners of the second class, as well as wetting agents, tend to increase tensile stress, while brighteners of the first class tend to decrease such stress, though at the expense of some ductility.

With respect to brightness, there is a general correlation with structure, although again, the detailed picture is not clear cut. Thus, there is a general correlation between increasing brightness and decreasing grain size,[35,36] and between increasing brightness and increasing hardness, but the correlation is valid only in a very broad sense. For example, certain anionic wetting agents decrease the hardness of the deposit, without affecting its brightness.[37] A study by

Leidheiser[38] of many organic brighteners showed that while the degree of cathode polarization caused by the brightener employed affects the structure and physical properties of the deposit, the correlation with brightness is not good. There also exists some disagreement as to whether or not orientation of the crystals is a requirement for brightness of deposit. In general, it appears that bright deposits from proprietary organic bright nickels are randomly oriented. However, the fine grain size of bright nickel deposits makes orientation studies difficult to carry out. Hoar[39] divides organic addition agents into two groups: (1) those which rapidly adsorb and desorb on the metal surface, in a completely random manner, maintaining at any given time a nearly complete monolayer and (2) those which adsorb specifically at sites which are also especially favorable to metal deposition. The latter type of organic addition agents cause brightening by being included in greater amounts on raised areas of cathodes, either by adsorption on the nickel surface, or by discharge in a complex ion. This is claimed to raise the deposition potential at high points, giving a submicroscopic smoothing effect, in leveling baths especially.[37]

On the other hand, Leidheiser[40] found that bright deposits could be obtained from a simple Watts bath by plating onto the (100) face of copper or nickel single crystals. On the (111) face of such crystals, matte deposits were obtained from a Watts bath, but eventually assumed a preferred (100) orientation. Actually, it has been known for years that nearly bright deposits can be obtained from high concentration, low *p*H Watts baths without addition agents, as long as excellent filtration is employed, there is complete freedom from metallic impurities, and high current densities are employed. However, as a practical matter, such baths are not useful in producing bright nickel deposits because the deposits are hazy or semi-bright at average current densities, stress is often high, and the bath has virtually no tolerance to metallic and inorganic impurities.

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Edward B. Saubestre is a native New Yorker. He received all of his education in New York City, graduating from Columbia University in 1945 with a BS degree. On returning from Army service, he re-entered Columbia in 1948 and four years later received the PhD degree. He is assistant to the Research Director of Enthone, Inc., a subsidiary of American Smelting and Refining Co., New Haven, Conn. Prior to his present connection he was an Engineering Specialist in the Chemistry Laboratory of Sylvania Electric Products, Inc., Bayside, N. Y.

Dr. Saubestre is president of the New York Branch of AES and a member of the Electrochemical Society, ACS, ASM, Institute of Metal Finishing, AAAS, N. Y. Academy of Science, ASTM committees B-8 and D-12 and EIA committee 40C. He has authored many technical papers that have contributed to electroplating literature.

ELECTROFORMING COPPER ON WAX AND PLASTIC MODELS

by ROBERT H. PASLEY*

FOREWORD

In the past when doing research in the public libraries, it has been found that priceless details were omitted from many of the technical books. As a firm believer in the maxim that "It is the little things that count," I have endeavored to explain in my own layman's terms step-by-step procedures. If any point helps a determined young man to progress toward his goal, this article is well worth the effort. —The Author.

MAKING THE CLAY MODEL AND PLASTER MOLD

IN MAKING THE CLAY MODEL the object desired is first rendered in clay, this requires the services of an artist well trained in making detailed models. The clay model is then cast in plaster (molding plaster obtained at any building or supply house is satisfactory).

If the model is of a simple design such as a doll face with one side open, the job is not too difficult. However, if a model of a complete doll or animal is to be cast, the split lines should be determined before the plaster cast is made. A very light coat of plaster is applied to the clay model and a thin (preferably nylon) string is laid along the predetermined split lines. Additional plaster is applied until the model is covered to the desired thickness with plaster, usually 0.5 to 1.0 inch is sufficient. As soon as the plaster has set slightly, the string is removed by pulling from both ends leaving a split line in the plaster. (See Figs. 1 and 2)

The model and plaster cast are allowed to set for at least 12 hours before removing the clay from the plaster. The plaster mold can then be split from the model by slightly tapping along the split lines with a knife or spatula inserted at the trim lines. (See Fig. 3) The inside of the plaster mold is washed with water to remove any adhering clay. In the case of an open-end mold the plaster is not split, but the clay is very carefully dug and washed from the plaster mold. (See Fig. 4 and 5) Sample parts may be cast of latex from the plaster mold if desired, for trial models.

* Executive Vice President and General Manager, Pasley's Plastic Products, Inc., Atlanta, Georgia.

MAKING THE WAX MODEL

The wax model is now ready for casting. The wax used in the method described is a one-to-one mixture of paraffin and number three carnuba. This mixture is melted over an electric hot plate until very hot (an oil or sand bath is preferred) the hot plate is turned off and the simmering wax is allowed to cool for approximately ten minutes, this allows any air bubbles to escape from the melted wax. This mixture we have found to be the most satisfactory, for if either of the waxes were used alone, the model would be too soft if made with paraffin, or too hard with carnuba, the blend used is ideal and can be highly polished as will be shown later in this article.

The plaster mold is dampened with tap water thoroughly just prior to casting the wax model. This dampening operation prevents the wax from penetrating into the minute pores of the plaster. The wax is then poured rapidly into the plaster mold, filling it completely in the case of an open mold. The wax is allowed to cool in the mold for five to ten minutes and the excess is poured back into the reservoir of wax. Slushing into the plaster mold with the wax is continued until the mold is completely filled, or if desired, the wax model may be left hollow. This process of slushing the wax has proved the most satisfactory in our experience. Shrinkage occurred from the surface of the plaster mold when the mold was poured full of wax and allowed to solidify.

For casting the split mold, the mold is also dampened thoroughly with water and one side is poured with wax (this time the wax should be poured very hot); the other side or parts should be quickly placed together and all split lines plugged with modeling clay. The closed mold is then rotated rapidly in all planes to coat thoroughly all inside surfaces. Rubber bands may be placed around the mold to hold it together. The mold should be rotated until all the wax is solidified and allowed to set for at least 12 hours or longer before any attempt to remove the plaster from the wax model. (See Fig. 6)

When removing the plaster from the wax, great care must be used to prevent defacing of the wax model. If under-cuts are present, it may be necessary to chip or cut the plaster from

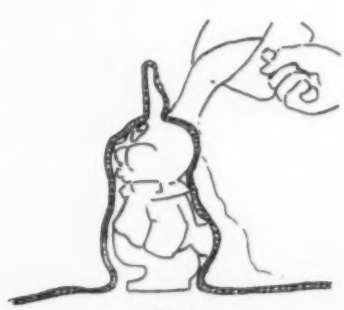

Fig. 1

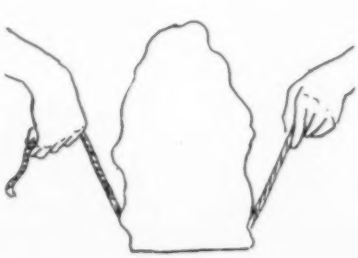

Fig. 2

Fig. 3

Fig. 4

Fig. 5

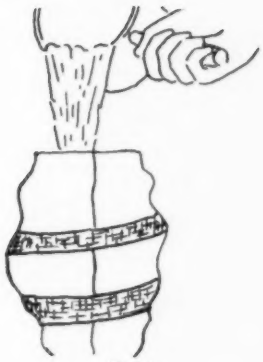

Fig. 6

the wax. Occasionally, a piece of the wax may become separated from the model; carefully save these pieces as they may be soldered or welded back in place with a hot knife or spatula. After removing the model from the mold remove any loose plaster by washing carefully under tap water.

CLEANING AND POLISHING THE WAX MODEL

The model is now ready for polishing. Any entrapped bubbles near the surface may be repaired by puncturing with a hot knife, inserting the hot point into the bubble. If a cavity or deep scratch is present, they may be filled by running additional wax from the hot knife into the defect. After repairing the model it is ready for smoothing the surface. This is accomplished with a regular grade of wood sandpaper; a long strip is cut for ease in handling. The model is then sanded lightly using care in making the strokes in the same direction each time and at the same time renewing the sanding strips as they become clogged with wax. After thoroughly smoothing out the surface the model is then gone over thoroughly with number "000" steel wool rubbing cross the grain or opposite the direction that was used with the sandpaper. The above operation is carried out very lightly to remove surface defects and scratches. After being satisfied that the surface is smooth, additional details may be carved into the wax if needed. (See Fig. 7).

The model is then ready for final polishing. It has been found by experience that the best manner to polish the models is under running water adjusted to room temperature. The model is held under the running tap water and with a soft, clean, well-washed, piece of ordinary toweling saturated with a liquid soap, we begin to wash and rub the model applying generous amounts of liquid soap. The model is rubbed in all directions and is periodically examined for minute scratches and if any are present, the model is polished across the grain of the scratches until none are visible. A 0.0625 or 0.0250 in. copper wire is then inserted in a non-critical area by heating the wire and allowing the wax to cool.

SENSITIZING THE MODEL FOR PLATING

The model is now ready for sensitizing to carry the electrical current. Various methods of making the wax conductive have been recommended: graphite, copper powders, silver nitrate reduction method, etc. However, the writer has not been able to get any of these methods to work properly. With the above uneven coatings, rough deposits and lack of conductivity of the current were encountered. The only material found by the author to be satisfactory is a silver conductive paste No. 4922.* Others may be equally satisfactory but the above conductive material is the only one which we have obtained satisfactory results.

The models are sprayed with the conductive coating by diluting ten ounces of silver to one gallon with methyl ethyl ketone. The silver will precipitate out and the solution must be shaken before each use. A light film is sprayed over the entire surface of the model and connection points (Fig. 8), the model is then submerged into the acid copper plating bath and low amperage of not over 45 amp/sq ft is applied (Fig. 9).

EQUIPMENT FOR ACID COPPER PLATING

The tank is lined with lead, plastic or glass. Our tank is lined with lead, however plastic lined tanks are to be preferred. Suitable anode and cathode bars are made of copper rods of varying diameters and should be determined by the size of the tank work load, etc. A motor generator set supplying low voltage, rheostatic controlled, is satisfactory, however the selium rectifier, tap controlled, has been found by the author

* Made by E. I. DuPont de Nemours and Company, Electrochemicals Division, Wilmington, Del.

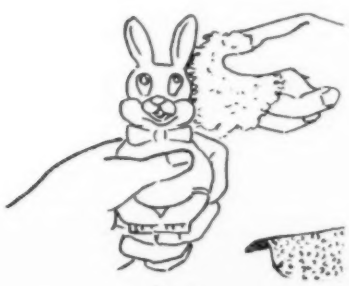

Fig. 7

Fig. 8

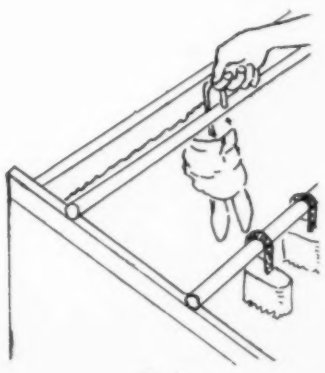

Fig. 9

Fig. 10

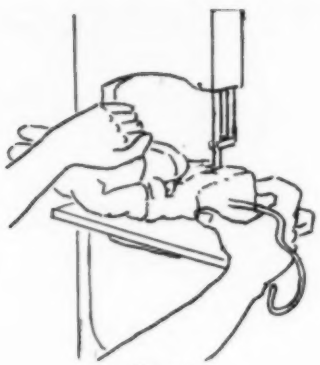

Fig. 11

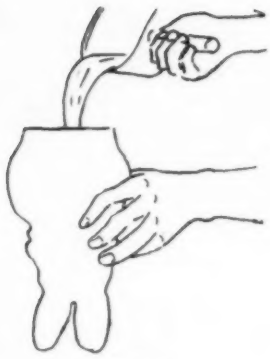

Fig. 12

to be the most satisfactory. The capacity of the rectifier is also governed by the work load desired. Zero to 300 amp has proven satisfactory in most instances for average size plating baths (three to 600 gallon capacity).

Air lines for agitation of the solution can be made of plastic or lead with drilled perforations located uniformly below the solution level and coiled evenly around the bottom of the tank.

One or more quartz immersion heaters should be used for maintaining the solution temperature. Filters made of rubber or plastic should be used for continuous or occasional filtration. A word of caution on filtration equipment: Be sure to have a guarantee that the filtration equipment will work, for past experience has shown that some filters cause considerable difficulty, i.e., packing leakage, inferior impellers and non-corrosion resistant components.

A few lead anodes should be included to control excessive amounts of copper in the solution.

THE ACID COPPER SOLUTION

The level of the acid copper solution should be determined before any addition is made to the tank. Generally six inches from the top of the tank should be satisfactory. The inside dimensions of the tank should be measured and converted to cubic feet of solution desired. The cubic feet can then be converted to gallons of water by multiplying the cubic feet by 7.48. Also, pounds of water the tank will hold can be determined if a solution is to be made percentage wise.

After determining the gallons of water the tank will hold the following formula is used and found to be most satisfactory. Numerous variations and additives have been tried but the following composition has been standard in our plant for the past four years:

Formulation of Acid Copper Plating Solution*

Potassium aluminum sulfate (alum)	1 oz/gal
Copper sulfate, $CuSo_4$-6 H_2O	30 oz/gal
Sulfuric acid, H_2SO_4	10 oz/gal
Black strap molasses	1 pt/100 gal
For throwing power add:	
180 proof ethyl alcohol	.5 oz/100 gal
Temperature	90F

Initial or beginning of the plating should be controlled at a low amperage of 20 to 30 amp/sq ft. The uniformity of the coating on the item being plated should be checked for the first two or three hours. After obtaining a uniform coating, the amperage may be increased. Higher amperage may be used if vigorous agitation and rotation of the cathode is employed

Satisfactory molds may be obtained in two or three days from time of starting, under normal operating conditions. (See Fig. 10) The plated model is then removed from the plating bath and the excess copper sawed from the mold. (Fig. 11) The mold should be stress relieved by heating to 350 to 400F for four to six hours. Any thin or recessed areas should be strengthened by brazing with No. 23 copper brazing rod (a low melting brazing rod M.P. 850F approx.). The mold is allowed to cool and then liquid honed or vapor blasted to clean the inside surface of the mold.

Nickel plating the inside of the mold to give a corrosion resistant surface and better mold release is obtained by using the immersion nickel plating method.†

* Used by Pasley's Plastic Products, Inc.

† The Charles Pfizer Chemical Company's recommendations are satisfactory.

Fig. 13

Fig. 14

Fig. 15

The finished master mold then may be slushed or rotated with plastisol, jelled and fused and used for sample runs. Each production mold needed may be reproduced in the same manner as the master mold. However, the plastic part obtained from the master mold must be filled with wax to hold the item in shape. This is accomplished by taping with paper sealing tape around the outer edges of the plastic, inserting the copper wire before the wax hardens and sensitizing the plastic part the same as the master mold. Make as many production molds as required by repeating this process. (See Figs. 12 to 16).

MOUNTING THE MOLDS FOR RUNNING PRODUCTION PARTS

The finished molds may be mounted in aluminum boards for ease in handling on production equipment. The mounting is very simple, any local aluminum foundry may mount the molds, by following this procedure:

The dimensions of the size of the aluminum mounting is predetermined and governed by the processing equipment. A one-quarter inch micarta, plywood or similar slick board should be used. The finished mold is laid upside down on the pre-cut board and the size marked on the board. As many parts as practical are mounted on the board. The board is then jigsawed, leaving holes in which each mold is placed. The molds and the board pattern are then sent to the foundry. The foundry will take a bottom board and place the pattern with the molds located outside up and enclose the pattern and molds in a flask which is rammed with sand. The flask is then turned over and the opposite side of the flask is placed on the first flask. This is also rammed with molding sand. The flask is separated and the wooden pattern removed—gates, risers are cut into the sand—the flask is closed and aluminum is poured into the cavity left by the wooden board, locking the molds into a one-quarter inch plate of aluminum.

TROUBLE SHOOTING AND ANALYSIS FOR COPPER IN AN ACID COPPER SOLUTION

Difficulty	Solution
1. Burnt edges and parts:	Reduce Amperage
2. Excessive roughness, large grains:	Add small amount of molasses, check amperage for excessive amount.
3. Flake copper and copper sludge on parts:	Excess copper dissolved in solution. Remove anodes and plate out excess copper on dummy cathodes.
4. Slow plating build-up:	Check copper content and specific gravity of solution.

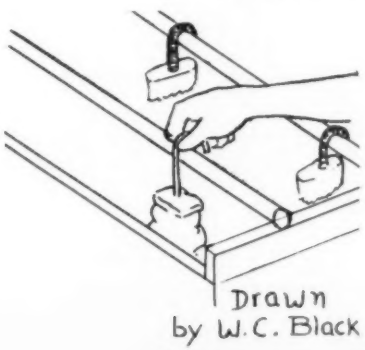

Fig. 16

Solution should last indefinitely if additions are made periodically.

Maintain specific gravity at 11.75 for best results by addition of sulphuric acid.

Continuous filtration is to be desired, however, periodically complete batch filtration is satisfactory.

The analytical procedure for copper metal in an acid copper solution is as follows:

1. Pipette a 5 ml sample into a 250 ml flask.
2. Add 100 ml distilled water.
3. Add conc. NH_4OH until solution turns a dark blue. Boil for 15 minutes.
4. Add 10 ml of 30 per cent acetic acid (the solution should be colored a light blue).
5. Cool to room temperature, add 25 ml of 20 per cent KI and shake.
6. Titrate with std. sodium thiosulfate until the brown color begins to turn yellow.
7. Add 2cc of one per cent starch solution and continue to titrate until the blue color disappears for one minute.
8. **Calculation:**

$$\frac{20.9}{\text{ml of sodium thiosulfate required for 0.2 g Cu}} \times \text{cc of sodium thiosulfate required for sample of solution} = \text{oz/gal of } CuSo_4 5H_2O$$

Robert Howard Pasley Sr. was born in Gadsen, Alabama but grew up in Atlanta, Georgia, where he now resides. At the age of sixteen he was a chemist helper. He continued his chemical education by taking night courses and doing research work at the public library. He has held positions with the State Department of Agriculture Laboratories, the International Agriculture Corporation and in the State Department of Geology. He was chief chemist for the National Traffic Guard Company, where he built a complete laboratory and set up methods for analysis, he was promoted to head melter and made all types of electric steel.

During the war years he was chief chemist at Bell Aircraft Corporation, Marietta Division. There he built a complete laboratory, wrote all chemical procedures and set up complete chemical control. He also ran vibration, metallurgical and structural tests for engineering. While there he received a number of Awards for Development.

He also held the position of metallurgical observer for the Atlantic Steel Company, and for a number of years was plant manager of Lester Laboratories, Ltd. At present he is executive vice president and general manager of Pasley's Plastic Products, Inc. of Atlanta, Georgia.

INEXPENSIVE APPARATUS FOR INTERFEROMETRICALLY MEASURING THICKNESS OF ELECTROPLATED CHROMIUM AND OTHER THIN FILMS

by ROGER L. SAUR*

ABSTRACT

Interference fringes are used to measure film thickness at the beveled edge of the stripped film. Necessary optical equipment are a microscope equipped with vertical illumination, a monochromatic light source, and a piece of sufficiently flat, transparent glass laid on the specimen. Thickness measurements are possible to at least 100 microinches (0.0001 in.) with accuracy around two microinches (0.000002 in.). The surfaces concerned must be of near-mirror quality. No thickness standards are necessary.

INTRODUCTION

IT HAS RECENTLY BECOME APPARENT that thickness of thin films, especially of chromium and of aluminum anodic films, is probably an important factor in corrosion resistance. Probably the best method of chromium thickness measurement is the deviation of interference fringes seen in an interference microscope at the edge of a stripped portion of the chromium film.[1, 2] With a good interference microscope, it is not even necessary to strip anodic film in order to measure its thickness.[3] However, such microscopes are expensive. A less expensive alternate is suggested in this article.

Whenever two quite flat glass plates, such as microscope slides, are held in contact and oriented so that a dark background is seen through the plates and a broad light source is seen as a reflection, interference fringes can be seen. The dark fringes are located in those areas where the two reflections of a single light beam from the adjacent glass surfaces are out of phase, the cancellation resulting in an area of little reflection of light. Fig. 1 represents two such flat glass surfaces nearly in contact. A beam of light of wavelength λ falls on them at an angle, Θ, to the surface, and is reflected at the same angle in beams 1 and 2.

For our purposes, the angle Θ is considered practically equal to 90 degrees, as the surface will be viewed vertically with a microscope, so that the light beam undergoes only a negligible angle change on passage to a medium of different refractive index. The perpendicular distance between the surfaces is d. The optical path distance a beam traverses to the second surface is therefore μd, where μ is the refractive index of the material between the surfaces (μ = 1 in air). The total path length difference is twice this value after reflection, or $2\,\mu\,d$. For destructive interference to occur, this path difference must be such that the two reflected beams be out of phase. The remaining fact necessary to determine the relationship for destructive interference to occur is that the phase of the light is reversed when it is reflected at a boundary from the lower refractive index side. (Generally this will occur at the second reflective surface, the lower one in Fig. 1.) Therefore, the condition for destructive interference is that the optical path difference between reflected beams 1 and 2 equals an integral number n of light wavelengths, or

Equation 1: $2\,\mu\,d = n\lambda$ for dark fringes.

With a slight angle between the surfaces (it is difficult to place one surface on another without a sufficient angle between them), a number of fringes can be seen, each of which will act as expressed by the above equation. Any given fringe will deviate laterally along the surface such that the distance between plates remains constant, and the lateral spacing between adjacent fringes will correspond to a change in optical distance between the plates of one-half the light wavelength used (a distance change of about 10 microinches for green light). By using monochromatic light and by adjusting the angle of the reflecting surfaces, the fringes can be made sufficiently narrow so that a microscope must be used to resolve them. And by making one surface flat to a fraction of a light wavelength, the lateral fringe deviations from a straight line will indicate changes in topography of the other surface.

Any highly reflective specimen will serve as the second mirror surface. A very useful interference microscope can be made with a microscope equipped with a vertical illuminator, a monochromatic light source, and a small piece of microscope cover glass (as the glass surface) placed on a bright plated surface (as the mirror). For inverted-stage microscopes, the piece of cover glass can be made to adhere by pressing it in place on a drop of water on the metal surface with an absorbent to remove excess water.

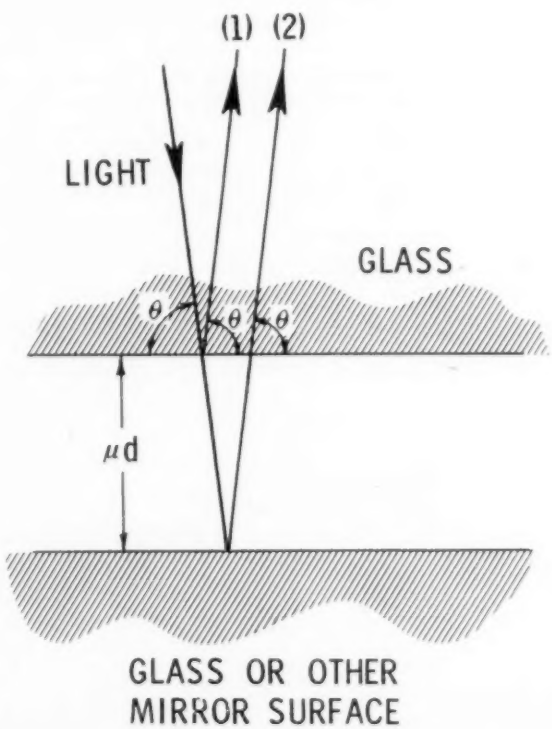

Fig. 1. Interference of light on reflection from two adjacent flat surfaces.

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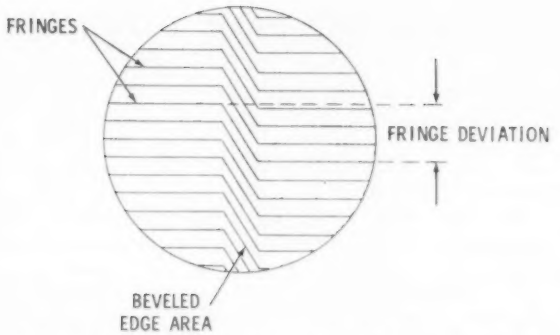

Fig. 2. Drawing of fringes across beveled boundary as seen through microscope.

Thickness of electroplate, such as chromium, can be determined by viewing the beveled edge of a stripped portion with the above apparatus. Beveling is necessary in order to determine the whole number of fringe deviations across the edge. (If the etched edge is too abrupt, the fringes on the bevel cannot be visually separated.) Fig. 2 is a drawing representing what might be seen through a microscope at a beveled edge of chromium electroplate.

PROCEDURE

A good method of obtaining a bevel while stripping chromium has been developed by Thomas.[2] A portion of the metal film is protected in a heavy liquid (e.g., perfluorocyclo octyl ether) during the stripping. Thomas (private communication) reports that a better method for stripping chromium from nickel is by anodically etching in dilute (about five per cent) chromic acid solution, using the heavy liquid as before. Electrolysis is halted at the first appearance of gas bubbles on the specimen, as continued electrolysis makes the desired bevel more abrupt. For chromium on steel, stainless steel, or chromium type stainless steel, stripping is performed anodically in an alkaline solution.

After the sample is stripped, it is viewed through the microscope equipped with vertical illumination. The light used must be monochromatic, most commonly obtained from a low-pressure mercury lamp (filtered to isolate the green radiation). Magnification of the microscope is usually about 100×. A piece of microscope cover glass or suitable glass surface is laid on the nickel-chromium boundary in the field of view. The fringe deviation n is estimated and the thickness d calculated by equation 1, which can be rewritten

$$d = \frac{n\lambda}{2\mu}.$$

For example, a fringe deviation of 3.2 is observed in mercury green light, wavelength 21.5 microinches (5461 angstrom units).

$$d = \frac{n\lambda}{2\mu} = \frac{3.2 \times 21.5}{2 \times 1} = 34.6 \text{ microinches thickness.}$$

If water ($\mu = 1.33$) is between the surfaces, a fringe displacement of 3.2 would give

$$d = \frac{n\lambda}{2\mu} = \frac{3.2 \times 21.5}{2 \times 1.33} = 25.8 \text{ microinches thickness.}$$

Thicknesses as much as 100 microinches have been measured with ease by this method.

DISCUSSION

Sharpness of fringes depends on monochromaticity of the light. For this reason, a monochromatic source, such as a low-pressure mercury lamp (with appropriate light filter) or a sodium lamp, is recommended. The microscope lamp can be replaced with a common germicidal mercury lamp. The green light is isolated by absorbing the other visible radiations with an appropriate filter. Many microscopes may already have an accessory green filter that is adequate, or a green Wratten 77 or a 58 filter can be used. The 58 filter is sold as a Wratten B filter at many camera stores.

Any small, smooth piece of glass will serve as a reference surface—a piece of microscope cover glass, a small glass window, or even a small convex lens. Optical flatness is not a serious problem as the area inspected through the microscope is small. However, if the contact area of the glass to the surface is spread over too large a surface, it may be difficult to obtain usable fringes in the desired area. A convex lens offers a limited contact area, with the disadvantage that the fringes are circular, not straight. Cover glass can be broken to about any desired size and is therefore recommended.

The above interference technique will work on any good reflecting surface. Thickness of thin stripped edges of bright nickel or copper could be as easily measured. A transparent film, such as an aluminum anodic film, should also be easily measured by the same technique. However, as fringes are formed from the metal surface beneath and not from the top of the transparent anodic film.

The fringe deviation does not then indicate the change in height of the metal surface as it does for metal films, but the change in optical path length between the beam reflected from the bare metal surface and the beam from the metal surface under the anodic film. For the same reason, a pail full of water appears shallower when the bottom is viewed through the water than it does when the distance to the bottom is viewed through the air alongside the pail. As the change in optical path length is due only to the difference between the refractive index of the transparent film and that of air, the thickness d of the film then becomes

$$d = \frac{n\lambda}{2(\mu' - \mu)}.$$

In all cases, a beveled edge is necessary.

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Roger L. Saur received his BS in Chemistry in 1943 and his PhD in 1949 from Michigan State University. Since then he has worked at the General Motors Research Staff, Detroit, Michigan. Until 1955 he worked in the Physics-Instrumentation Department on the photochemical deterioration of automobile lacquer and other diversified projects. Since that time, he has worked in the Electrochemistry Department on various problems in electrochemistry and physics.

WHAT ELECTROLESS NICKEL CAN DO FOR YOU

by ROBERT J. GIRARD*

INTRODUCTION

During the past ten years, electroless nickel has grown from a chemical curiosity to an established and valuable requirement for the plating industry.

While a patent was issued by the U. S. Patent Office over forty years ago, it must be conceded that it was not until 1947, over thirty years later, that the first practical bath was developed at the National Bureau of Standards and patented by Dr. Abner Brenner and Grace Riddell.

Ten years have passed since the development of their practical bath, and this paper will try to sum up the progress made in industry during this time and what has been learned about a process that has advantage over electrolytic methods of deposition by producing uniform corrosion-resistant deposits in recessed areas and on intricate shapes, in a practical and economical manner.

Electroless nickel, like all chemical processes, has its own particular applications, and though it has certain advantages to warrant its use, one must take into consideration whether the cost justified its use in replacing the electrolytic method of nickel deposition.

Let us be practical: the usual method of coating a metal with nickel is by electrodeposition and this method is very desirable for heavy deposits wherever these heavy deposits can be achieved within a reasonable cost, and without having to use expensive and intricate racking devices. But when a light deposit is required to form a corrosion resistant coating of nickel on ferrous or non-ferrous articles, or where a uniform deposit is desired in recessed areas and on intricate shapes, or because the size of the area to be plated is too small to properly set and center an inside anode,—as required by the electrolytic method of nickel deposition, consideration should be given to the application of electroless nickel to the specific problem. Coating the interior of large vessels in another important application of chemical nickel application. It is considerably cheaper than electroplating and results in more impervious linings.

*Electroplating and Metal Surface Treating Foreman, Armory Operations Division, Armory Operations Division, Springfield Armory, Springfield, Mass.
▸ Paper presented at the January 1958 meeting of the AES, Springfield Branch Springfield, Mass.

PHYSICAL PROPERTIES

Laminated Amorphous

Electrolytic nickel deposits are crystalline in structure, but an electroless nickel deposit is a laminated amorphous deposit.

Because of its being an amorphous laminated deposit, its properties are such that it indicates better corrosion resistance and therefore, a thinner deposit usually can give the same results as a heavier deposit using the electrolytic method.

Appearance

On a buffed piece of metal, a very smooth, bright deposit can be obtained. The deposit brightness varies depending on what bath is being employed.

Corrosion Resistance

Thin deposits of electroless nickel give protection comparable to electrolytic deposits two or three times as thick. The corrosion resistance of chemical nickel deposits is superior to that of electrolytic (and wrought) nickel, not only because of the former's amorphous structure, but also as a result of the phosphorus contained therein as a solid solute. Nickel phosphides are, of course, known to be very inert. This point has been proven by numerous tests and industrial applications.

After immersion in cold HCl, comparison of a component covered with an equal thickness of electroless nickel to one with pure nickel will show the alloy will remain long after the pure deposit disappears.[1]

Buffability

The nickel coating is easily buffed.

Hardness

The hardness of chemically plated nickel is not as great as that of chrome, as shown in Table I, but it does have a low coefficient of friction and many good attributes because electroless nickel with 500 Vickers equals hard nickel; and the hardness of electroless nickel may be increased by a mild heat treatment at 400C to give a maximum hardness of 1100 VN.

TABLE I
ELECTROLESS NICKEL—PHYSICAL PROPERTIES‡

		Hardness (Vickers)	Elongation (Per Cent in 2 in.)	Tensile Strength (PSI × 10^3)
Nickel	Watts	100–250	10–35	50–80
	Chloride	230–300	10–21	90–125
	Hard Nickel	350–500	4–10	140–160
	Fluoborate	125–300	5–32	55–120
	Fluoborate + Additions	400–600	1–4	20–200
	Sulfamate	200–550	6–30	60–130
	Sulfamate Chloride	200–625	3–5	94–155
	Nickel-Cobalt	300–600	——	——
	Electroless	500–780	0–3	——
Chromium	Standard	300–1000	0–0.1	10–30

‡Marv. Rubinstein, Metal Finishing, Feb. 1956

Composition

The original Brenner-Riddell Formulation produced the following nickel composition. Acid bath yields nickel deposit of 90 to 92 per cent and phosphorous 8 to 10 per cent. Alkaline bath yields nickel deposit of 92 to 93 per cent and phosphorous 7 to 8 per cent.

Studies have been made during the past ten years and baths of newer chemical composition have been developed with the following stated results.

The chemical composition of the deposit is a function of bath composition *and* of *p*H. For instance, a solution containing 0.08 mpl of nickel cations (as nickel sulfate) and 0.225 mpl hypophosphite anions,* plus lactic ion (chelating agent and buffer),† propionic ion ("exaltant"),‡ and a stabilizer†† will give deposits of the following composition as a function of bath *p*H:

*p*H	Ni Per Cent	P Per Cent
5.5	92.5	7.5
5.0	91.3	8.7
4.5	90.6	9.4
4.0	89.7	10.3
3.5	85.4	14.6

The phosphorous content of coatings produced in buffered alkaline baths can be as low as 3.0 per cent.

Ductility

A physical deficiency of electroless nickel is brittleness. This can be partially alleviated by heating the plated component at 750 to 800F for 30 min. If not possible to heat at the above stated temperature, 400F would be satisfactory, but a longer period would be required.

Brittleness of the deposit can be alleviated only to some extent by heat-treatment (particularly sensitivity to shock); but it represents the one serious drawback of "electroless" plating, which, so far, could not be corrected, because it is not due to internal stresses (as suggested) but to the phosphorous content. (As little as 0.1 per cent P will cause brittleness of nickel).

It has been reported that greater ductility of electroless nickel can be achieved by heating the deposited electroless nickel at 750F for 30 min to one hour, but when this is performed, it must be kept in mind that the properties desired in the base metal may also be changed by heat treating the component and the nickel deposit at the temperature mentioned.

Receptiveness

Electroless nickel has been found to have an extremely active surface and is quite receptive, making an excellent undercoating for chromium, rhodium and silver. Electroless nickel has been found to be an excellent substitute for the "Wood strike," when used as a base for plating silver on steel components.

Porosity

Porosity is virtually negligible; only where base metal is pitted or defective, is porosity likely to occur. It must be remembered that the final finish of deposited metal is only as good as the base metal will permit.

Chemically resistant to:

1. Caustics
2. Soaps
3. Alcohol
4. Fats
5. Plastics
6. Petroleum products
7. Phenols
8. Chlorinated solvents
9. Water (including high humidity atmosphere)
10. Oleic acid
11. Stearic acid
12. Highly resistant to hydraulic fluid corrosion in airplane hydraulic systems

*U. S. Patent No. 2,658,841
†U. S. Patent No. 2,822,293
‡U. S. Patent Nos. 2,822,294 and 2,837,445
††U. S. Patent No. 2,762,723

ADHESION

Adhesion on low to medium carbon steel is such that it will not flake off by bending. However, adhesion is less satisfactory on high carbon steels. The adhesion can be improved by heating at 800F for 30 min.

PLATING TANKS

Stabilized baths* proper operating conditions, and passivating procedures for plating equipment (tanks, pumps, heat exchangers, etc.) allow the use of specific alloy steels for these purposes.

Therefore, with this latest development no glass lined vessel, glass pipes, synthetic resin lined steel tanks, pumps and heat exchangers are presently recommended for larger industrial installations.

Though the above has proven economically feasible for larger industrial installation consideration and appraisal must be given to the smaller type operations, where funds are not available or production is not of large enough volume to warrant this type of installation or process.

For small industrial installations a selection of material for plating tank lining requires that special consideration be given to the selection of the type of tank lining, since the hot solution will deposit on all materials. The tank lining surface should be smooth, non-porous and inert material, capable of withstanding the unusually high operating temperatures. Pyrex, fired enamel, phenolic resin and glass coated tanks have successfully been used for commercial plating installations. Stainless steel tanks coated with baked phenolic resin have been used and have proven quite successful. The ideal material for construction of the plating tank has not yet been found. Presently, a great deal of work is centered around the use of KFL and Teflon coated stainless steel tanks.

Phenolic resin used on smaller installation has shown limited coating life and eventually deteriorated because of high temperature. Glass would make a good container, except that when it is scratched through usual shop abuse it will ultimately plate. However, except for the danger of cracking or scratching, glass would appear to be the best suitable lining available.

Heating

Most small installations today use hot water jacketed tanks or hot oil with a high flash point as the method of producing the lowest temperature differential between the heating media and the plating bath.

Though many methods of heating have been employed, no set unit or method has yet proven to be acceptable for small units. Much work is yet to be done in the field of developing a suitable plating tank lining and a satisfactory commercial method of heating the electroless nickel plating bath for small units. All who have worked on this type of bath agree that direct heating of the bath is not advisable, as localized overheating will cause excessive deposition on the heated surface.

VENTILATION

The high operating temperature causes a considerable

*U. S. Patent No. 2,762,723

amount of steam and vapor to be evolved from the bath, therefore it is recommended that adequate ventilation be furnished. Also, since sodium hypophosphite is used, it is recommended that all who come in contact with the solution be certain to wash their hands before employing toilet facilities. Sodium hypophosphite can cause a rash, especially on sensitive parts of the body.

PREPARATION OF PLATING SOLUTIONS

Regardless whether a nickel chloride or a nickel sulfate bath is to be employed, it is essential that a few rules be adhered to. The correct procedure in making up the bath is important because this will facilitate the control of the bath during the hours of operation. The composition of all commercial electroless nickel baths contains at least the following as a base:

1. Nickel salts in the form of nickel chloride or nickel sulfate.
2. Sodium hypophosphite.
3. A buffer (Usually a member of the propionate *or the acetate family.)

Now, besides the above mentioned constituents, several added proprietary compounds are available, and when added to the basic formula, give very desirable results.

These patented processes certainly are worthy of investigation where large or small commercial installations are being contemplated.

For all practical purposes and since the author prefers to work with nickel sulfate for the remainder of this discussion, we shall use the nickel sulfate type bath as our plating solution. In preparing the bath, the following are important:

1. Procure good grades of chemicals.
2. Use demineralized water.
3. Filter bath prior to using. (More will be said when filtration of the solution is discussed.)

DEPOSITION OF NICKEL

The thickness is uniform on the most intricate shapes, and even holes as small as 1/8 in. in diameter, were found to be evenly plated the entire length. Thus throwing power is excellent, and the intricate shape of the article being processed has little effect upon the coating obtain. The more complex shape of the article being processed makes this solution that much more applicable.

RACKING OF COMPONENTS

There is nothing "holy" about the maximum area/volume ratio of 72 sq in./gal. As a matter of fact, in a circulating system, areas as high as 100 sq in./gal of bath have been coated with excellent results. In batch plating, of course, the A/V is quite critical.**

For best results, when not using a circulatory system, it has been proven that approximately 72 sq in./gal of plating solution is the maximum area allowable, the holders should be designed and the loading planned accordingly.

The exposed surface of these racks not in direct contact with the article to be plated should be stopped off by use of a suitable stop off material that will accommodate the high temperatures utilized during processing.

Racking problems of electroless nickel are really simple. Since there is no anode to worry about, and no problem of shieding or throwing power, the part can be merely immersed in the bath. Where a thin deposit is desired, the position of the component in the bath is unimportant, except that gas pocket formation has to be avoided.

*U. S. Patents No. 2,822,293 and 2,837,445
**U. S. Patent No. 2,658,841

Baskets and Plating Barrels

Racking is not the only method available for processing work in an electroless nickel bath. Work that is too small to be racked or articles that would prove too costly to rack for processing can be coated by being placed in a high temperature lucite or melamine barrel and slowly rotated, or by being placed in a basket and periodically shaken over a period of time.

On non-ferrous components, when processed in bulk, it is advisable to place enough ferrous components in the barrel or basket so that they will make the non-ferrous material start plating.

The rule of 72 (72 sq in. of work/gal solution) must be kept in mind when processing work by bulk methods.

OPERATING CONDITIONS AND THEIR CONTROL

If the component being plated has no complex shape problem, then the racking for a heavy deposit will be the same as for a light deposit. In respect to heavy deposits from an electroless nickel bath, we will go into more detail about racking of components with involved or complex shapes in such a way that gas is not trapped during plating.

For most efficient and economical operation, the largest possible work load should be processed per cycle and the rule of 72 kept in mind when not using a "circulating solution system."

Temperature Control

In a properly prepared, buffered nickel sulfate bath, the rate of deposition per hour is related to the temperature and will be approximately as follows, using 72 sq in./gal solution:

1.	180 to 190F	0.0005 to 0.0006 in./hr
2.	191 to 195F	0.0006 to 0.0007 in./hr
3.	196 to 204F	0.0007 to 0.00085 in./hr
4.	205 to 210F	0.00085 to 0.0011 in./hr

pH Control

The normal *p*H range of this bath is between 4.0 and 5.6. The plating rate is at its maximum at the upper *p*H range and therefore, to get a good steady rate of deposit, it is essential not only to have a properly prepared bath and accurate temperature control, but the *p*H is also a very important factor in obtaining a good rate of deposition. To maintain the proper *p*H, the use of sodium hydroxide 0.3 normal using a continuous flow method is recommended. The amounts of NaOH used is determined by the amount required to keep the solution within the operating *p*H range. The *p*H is lowered by the bath, reaction during plating When an article is placed in the bath to be plated, the action of chemical reduction is such that the *p*H will drop during plating.

The effect of *p*H on coating composition has already been discussed. While it is true that the rate of deposition increases with the *p*H (but not in a linear manner), bath stability and the solubility of nickel phosphite (an unwanted solid-by product) decrease at the same time. Therefore, in continuous production, it is impractical to use the higher *p*H values indicated above for the acid bath. Rate can be "boosted" by special additives.*

As was stated under "Preparation of the Bath," a buffer is employed to assist in controlling the concentration of free hydrogen ions formed by reduction of Ni to Ni°, thus helping to control the *p*H. Other buffering agents are now being added as substitutes or supplements to the acetate group. These baths show promise and appear to give better results than the original Brenner-Riddell bath.

*U. S. Patents No. 2,658,842, 2,694,019 and 2,837,445

The baths referred to are patented and are obtainable, or will be commercially available very shortly.

Buffering of Bath

The simplest and best explanation I have ever read on buffering of an electroless nickel bath is found in a patent and reads in part:

> With respect to the absolute quantity of buffer that has to be present in the plating bath, the chemical reaction* shows that, for every nickel ion reduced to the metal, two hydrogen ions are formed. In the absence of a buffer, the *p*H of the plating solution would, therefore, decrease rapidly below 4.0 with a corresponding loss of efficiency. The amount of buffer in the bath must, therefore, be sufficient to take care of the hydrogen ions that will be formed during the plating operation, i.e., corresponding to the maximum amount of nickel that can be reduced which, in turn, is a function of the quantity of hypophosphite ion available.
>
> The theoretical needed buffer concentration is the ion of an organic acid equivalent to two carbonyl groups for every nickel ion that can be deposited, for example, two moles of acetate for one mole of nickel. An excess of buffer, on the other hand, is objectionable, since it will lead to the formation of basic nickel salts. The amount of buffer which will give the best results may be readily determined by calculation.[2]

Agitation

When possible, agitation of the load is recommended. A rate of agitation at 16 ft/min will give a more even deposit, especially on components that have intricate shapes and require heavy coatings of nickel. Excess agitation should be avoided.

In 1954, at the AES Convention, Gutzeit and Landon[3] reported that just as is required in electroplating, it is necessary to orient the part properly, or to provide either horizontal or vertical agitation or rotation during processing, so that gas will not be entrapped during plating. Gas evolution in an electroless nickel bath is somewhat in excess of that normally produced by electrolytic nickel plating, and so care must be given to the problem of gas entrapment.

FILTRATION

It has been found that constant filtration of the plating solution, while in operation, will aid in obtaining a uniformly smooth deposit. The removal of impurities is essential if good results are to be achieved in this type of bath.

It is very important in preparing a solution that not only a good grade of chemicals be used and that the water be demineralized, but before using the plating bath, it is recommended that the solution be filtered to remove impurities and thus achieve better plating results.

A great deal of work was done on filtration and reported by Eisenberg and Schneider[4] who recommended:

1. Heat nickel sulfate and sodium acetate, and agitate solution for an hour or longer; then add 4 lb of activated carbon per gal of plating solution.
2. Allow to stand overnight.
3. Use a precoat made up of 2 oz filter-aid per sq ft of filtering area.
4. Then proceed to filter solution.
5. After filtering, add sodium hypophosphite at room temperature.

The solution is then stirred up, and after being heated to proper operating temperature, the solution is ready to plate.

*$Ni^{++} + 2H \rightarrow Ni^{\circ} + 2H^{+}$

Use the same filter cake as just described when using constant filtration, but during operation the use of carbon is to be avoided. For proprietary baths, use the manufacturer's recommendation for filtration prior to use or in regard to constant filtration methods required during operation.

CYCLE OF OPERATION

It is well known that the pretreatment to be used for best results in chemical nickel deposition (even more so than in electroplating) varies with the nature of the base material to be coated.

The following cycle is merely a guide that can be modified to suit the particular type of base metal being processed.

1. Vapor degrease article to be plated.
2. Place in soak cleaner at 200F for 10 min. Agitate work manually, or hand scrub if necessary.
3. Rinse in cold water.
4. Place in acid tank using hydrochloric or sulfuric acid. Excellent adhesion to steel can be obtained by using a dip of concentrated (95 per cent) sulfuric acid.
5. Rinse in cold water.
6. Place article in hot nickel plating solution of the proper *p*H; temperature between 196 and 204F.
7. Rinse in cold water.
8. Bake in mild alkali for 5 to 10 min at a temperature of 180F (optional). (Step 8 may be omitted if no heat treatment is to be made.)
9. Rinse in cold water.
10. Rinse in hot water.
11. Air dry or wipe off with soft cloth.

Replenishing of Bath

During operation of the bath, its constituents require replenishing. Continuous additions of sodium hydroxide are far superior to making one large addition periodically. When continuous additions are made, the *p*H remains fairly stable, and if all other constituents of the bath and the temperature remain stable, a fairly steady rate of deposition over an especially long period of time is obtainable. Sodium hydroxide should never be added to the bath in solid form. It should be diluted in distilled water to make a solution of 0.3 normal Na(OH), and the solution added gradually to the bath.

Addition of Nickel and Sodium Hypophosphite

As the bath's constituents become gradually depleted, it is necessary to make additions of nickel, sodium hypophosphite and buffer. For maximum efficiency, additions should be made continuously.

Bath Life

After use of the bath, the concentration of reaction products will increase until the deposition rate is affected. Regeneration of the bath is possible but only to be recommended for larger baths. Before discarding smaller baths (up to 15 gal), they are worked until the metal content of the bath is depleted.

Removal of Nickel plated Coating

The removal of electroless nickel plate from the plating tank or from steel can be achieved by the use of nitric acid (95 per cent).

Another method of stripping nickel from copper alloy base metal, recommended by Eisenberg,[5] is:

Hydrochloric acid	1 part
Water	19 parts
Temperature	room
Volts	6

This method may remove some of the base metal.

A national distributor of electroplating chemicals has developed a stripping material capable of removing an electroless nickel coating without damaging the base metal, provided the nickel phosphide alloy contains no more than eight per cent phosphide. This material can be used to remove coatings from containers as well as from ferrous and non-ferrous components.

Limitation of Electroless Nickel

In a paper presented at the AES National Convention in Washington, D. C., in 1956, Moeller and Snell reported on their findings from an experiment conducted to determine the reduction in endurance limit due to electroless nickel plating on jet engine parts. Plated and unplated parts of identical base characteristics were vibration tested.

Moeller and Snell observed that plating reduced fatigue strength 25 per cent and cracked plate reduced it another 45 per cent. The brittleness of the plate eliminates its use on stressed internal engine parts. Brittleness at this temperature does not, however, preclude the use of electroless nickel on low stressed, low alloy materials operating at low temperature, particularly where the advantages of the electroless affords greatly improved corrosion resistance in recessed areas.

ADVANTAGES AND APPRAISAL

Throwing Power

Excellent uniform deposit in all recessed areas regardless how intricate the shape.

Elimination of Anodes

Labor saving in construction of auxiliary anodes.

Corrosion Resistant

Because of its amorphous structure, the porosity of electroless nickel is negligible and therefore this coating is far superior in corrosion resistance to electrodeposited nickel of an equal thickness.

Hard Deposit

Very good for parts subject to wear. The deposit is approximately 500 Vickers and has lower coefficient of friction than electroplated nickel, thus making it desirable for industrial usage.

Adhesion

Excellent on low to medium carbon steel and good on other types of steel and nonferrous metal. Excellent where plating specification call for application of a nickel strike on steel prior to silver plating.

Chemically Resistant

Resistant to a very large variety of chemicals previously mentioned.

Cost Comparison

Before going into a cost comparison of electroless nickel versus electrodeposited nickel, let us remember what we said at the start of this discussion. Electroless nickel has many advantages to warrant its use, but one must always take into consideration whether the cost justifies its use in replacing the electrolytic method of nickel deposition.

Conceding that the cost of materials at the present time is substantially higher than that of electrolytic nickel, permit me to point out several advantages justifying the use of electroless nickel.

Savings in Labor Cost

Since it is not necessary to construct or maintain specialized rack and anode assemblies, and since no anodes or electrical connection are required and racks are very simple, large labor savings cost is thus achievable.

Savings on Material Cost

It stands to reason that since no special racks are necessary, the cost of material required to construct the necessary racks will be at a minimum.

Thin deposits of electroless nickel give protection comparable to electrolytic deposits two or three times as thick. Thinner deposit yielding the same protection means less labor and chemical cost in the finished article. Taking into consideration the critical conditions existing today regarding the availability of nickel, we all see the advantage of getting the maximum corrosion protection desired while applying the minimum of nickel thickness.

Electroless nickel, with assistance of special brightness, yields coatings of relatively high brilliance on decorative parts which are comparatively difficult to plate electrolytically. This holds especially true for internal coating or in the cases of shaded areas on the article being plated. In the case where hardness of the nickel coating without cracks and internal stresses is desired, this bath is quite suitable.

The cost of application is less than electrolytic nickel in many cases, especially for coatings of 0.0003 thickness or more. Taking everything into consideration, and after proper evaluation, it will be found that electroless nickel has its own particular field of application, and it is here to stay.

The more we familiarize ourselves with the attributes and advantages of the electroless nickel process, the more reasons will be found to justify its use, as a replacement of the electrolytic method we now employ, in many of our present day applications.

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[6]Moeller, R. W. and W. A. Snell, Limitations of Plated Nickel in Jet Engine Design, AES Tech. Proc., pp. 230–233, 1956.

Robert J. Girard is foreman of the Metal Finishing Shops of the Armory Operations Division at the Springfield Armory, Springfield, Massachusetts, with technical responsibility for all metal surface treating and plating operations on a production basis.

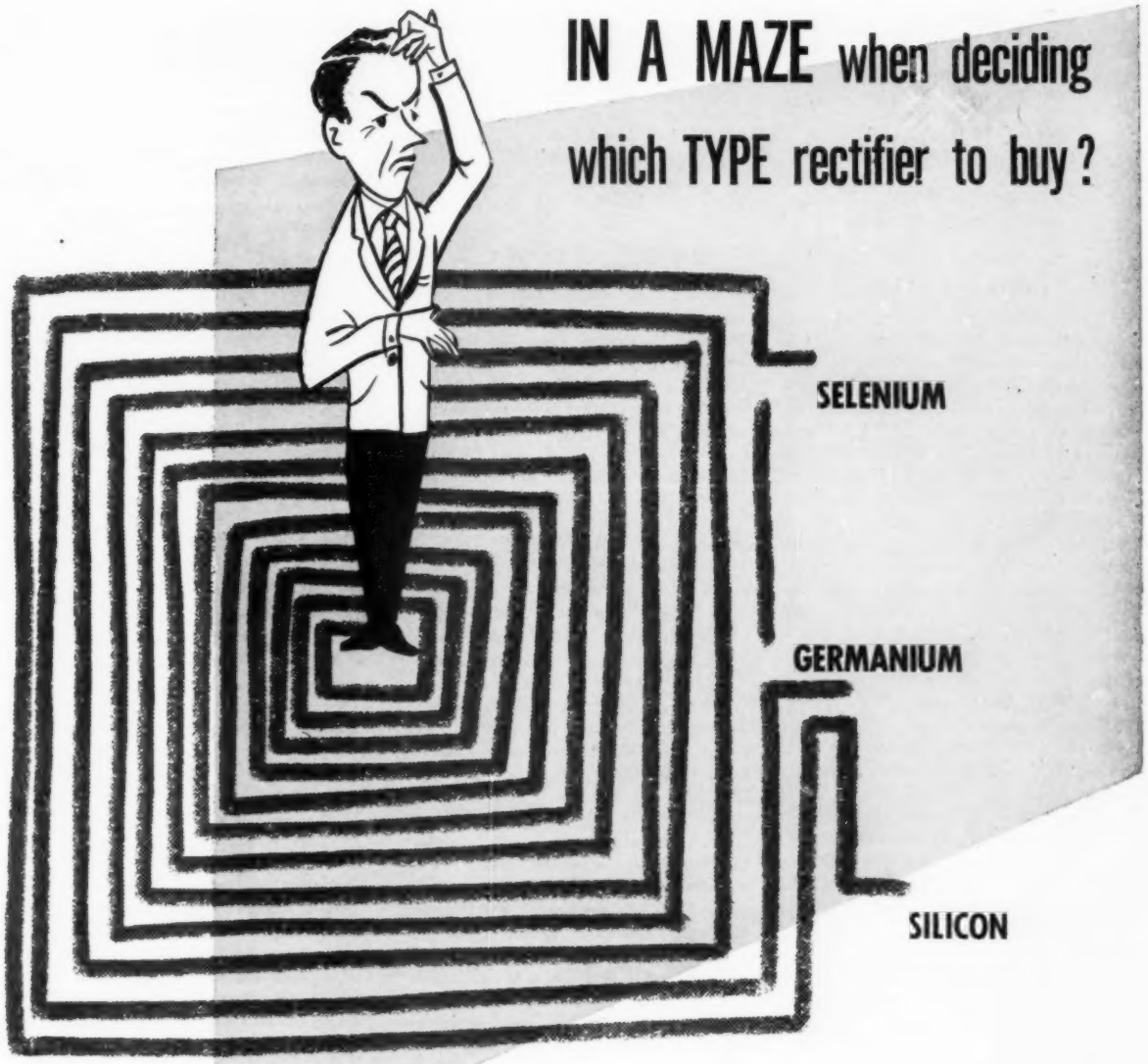
A native of Chicopee, Mass., where he was educated in the local schools, he has attended Syracuse University, evening courses at University of Massachusetts and North Eastern University.

His practical shop background includes part ownership and operator of a job shop for five years, electroplater for four years doing research and development work at the Springfield Armory Laboratories.

He has done work in the development of techniques for hard chromium interior bore plating of gun barrels and adapting the newly developed cycles for future production processing, as well as developing finishes for a variety of other Ordnance components.

Mr. Girard has done considerable work in the field of hard chromium plating for industrial purposes and salvage work and has received a patent on an electroless nickel sulfate process.

He is past president of the Springfield Branch of the AES, a member of the New England Regional Committee for the past five years and conducted a course in "Fundamentals of Electroplating" sponsored by the Springfield Branch in 1957.



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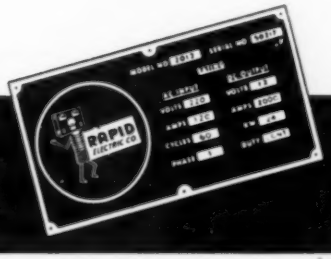

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Summary by
Dr. Edward B. Saubestre
Assistant to Director of Research
ENTHONE, Inc., New Haven, Conn.

Semi-Annual Meeting COMMITTEE B-8

AMERICAN SOCIETY FOR TESTING MATERIALS

Columbus, Ohio
October 22-23, 1958

Sub-Committee I (Specifications)
Chairman—FIELDING OGBURN

A list containing about 200 definitions of electroplating terms has been sent out for balloting by W. Safranek. Dr. Dodd Carr reported on a tentative specification which he has drawn up for "Electrodeposited Coatings of Nickel on Steel for Engineering Use." This specification covers heavy nickel coatings on steel, where protection against corrosion, wear, abrasion, erosion or oxidation of the substrate is the principal factor. W. Moline reported that the Monograph on "Electroless Nickel Plating" is practically complete. This report will probably be issued as a Special Technical Publication of ASTM, rather than as a Standard. Dr. Lowenheim reported on the activities of the Editorial Review Section. Dr. Saubestre reported that the Section on "Marking of Plated Coatings" feels that meaningful ASTM thickness designations must be developed before cooperation can be sought from professional and trade organizations. A Section was established on "Bright Nickel Coatings." This group will review ASTM Standards and Recommended Practices, to determine if any modifications or additions must be made to reflect the properties of bright nickel deposits. Another Task Group was set up to provide a general review of All ASTM Specifications under the jurisdiction of B-8. The two main purposes of the group will be to review thickness requirements (especially for industrial coatings, and deposits on die castings) and to review designations employed in ASTM Standards.

Sub-Committee II (Performance Tests)
Chairman—WALTER L. PINNER

Dr. Lowenheim reported for the Section on Solderability. After careful examination of various tests for solderability, it was decided to use the Pessel test. This is a spreading test, in which the light of a drop of solder is measured under controlled conditions (430F; 45 sec; 50-50 solder; 10 per cent rosin-alcohol flux). The testing program is now underway.

J. W. Kerstetter reported that the Section on "Aluminum and Its Alloys" has polished some aluminum panels and that plating will begin shortly.

The principal portion of the meeting was taken up with a report by D. M. Bigge on the current status of the corrosion testing of copper-nickel-chromium panels which have now been exposed at Kure Beach for two years. The outstanding result to date is the wide variation in results obtained on panels plated by different laboratories. In spite of considerable effort to specify the plating conditions as closely as possible, the plater-to-plater differences were often greater than the differences caused by the testing program. In general, Watts nickel deposits continue to show better results than bright nickel deposits, when other factors are comparable. In the range of 10-60 millionths of an inch, corrosion resistance improves with increasing thickness of chromium deposit. However, the thicker chromium deposits are hazy and mottled in appearance. The effect of a copper undercoat is not clear and no consistent results may be drawn. However, in the absence of copper, corrosion tends to be of the pin-point variety, while in its presence, crater-type corrosion predominates. There is slight evidence of a possible superiority of buffed crack-free chromium over conventional chromium.

Sub-Committee III (Conformance Tests)
Chairman—A. D. SQUITERO

A. H. Du Rose discussed a report prepared by his Section, covering methods of determining thickness of electrodeposits. It was found that the various cooperating laboratories differed significantly among each other on all test methods. Except for zinc, significant differences were also found between all test methods for all metal coatings examined. In general, with a few exceptions, Magne-Gage and microscopic methods gave higher results than stripping methods. On zinc, dropping tests are comparable to microscopic methods. Mechanical and heat treatments of the plated surface also altered the results obtained by the various test methods to a significant degree. Dr. R. E. Harr reported on further thickness testing programs which involve use of commercially available instruments. To date, results are available only on the Dermatron.

It was reported that R. E. Shaw is presently accumulating data on adhesion tests. L. Morse reported that considerable data has been accumulated on stress measurements for various coatings, using three methods of test: The Helical Contractometer, The Stresometer and the strip method. In general, the amount of stress recorded on a given deposit decreased in the order of instruments given above.

D. H. Hanna reported that Dr. Harold Read has offered his services to the Section which is currently investigating ductility tests.

Sub-Committee IV (Recommended Practices)
Chairman—EDWARD B. SAUBESTRE

The Section on "Cleaning", headed by Dr. S. Spring, was discharged with thanks, its work having been published in the form of an ASTM Recommended Practice on "Cleaning of Metals Prior to Electroplating." Dr. B. B. Knapp reported that this Section has drafted a tentative Recommended Practice on "Preparation of Nickel for Nickel Plating." This report is now being circulated to interested members. In effect, the production of duplex nickel coatings is being considered, a factor of considerable importance in corrosion protection.

Bennie Cohen was appointed chairman of a new Section on "Chromium Plating on Chromium Surfaces." The principal function of the new group is to investigate the feasibility of re-chromium plating parts which have been hard-chrome plated and partially stripped or ground down.

It was agreed that ASTM Specifications dealing with descaling of stainless steels and related alloys would be modified to include electrolytic molten caustic descaling processes.

H. A. Kafarski reported that his Section is proceeding at a satisfactory pace in the development of an ASTM Specification on "Industrial Water for Electroplating Use."

Sub-Committee V (Conversion Coatings)
Chairman—E. C. BERTUCIO

Dr. R. E. Harr reported on the present status of the corrosion testing program on chromated zinc and cadmium plated steel panels. The test on zinc plated panels has had to be abandoned, owing to the very slight differences found between untreated and treated panels after an exposure time of one year. After considerable discussion, the unexpectedly good behavior of the untreated zinc panels was attributed to the fact that these panels were stored in polyethylene bags for a period of time. Later tests in this program will probably concentrate on correlation between performance and indoor accelerated corrosion tests. Observations on chromated cadmium plated surfaces are continuing. No final conclusions have been drawn as yet, although it is apparent that metal couples (especially those involving copper and its alloys) are of considerable importance in determining the amount of corrosion observed.

G. Pimbley reported on the program devoted to zinc phosphate treatments for steel. The "Springfield Immersion Test," which involves testing at 65C causes too rapid failure, except on painted surfaces. For unpainted surfaces, Mr. Pimbley recommended treatment at room temperature in aerated 2 NaCl. The mechanism of failure is similar in both tests, but failure occurs much less rapidly in the latter test. These tests are also being correlated with the salt-spray test.

Committee B-8
Chairman—CLARENCE H. SAMPLE

Most of the meeting concerned a review of the above Sub-Committee activities. There was also a considerable discussion of the relative roles of Committees B-7 and B-8, concerning anodized coating on aluminum and magesium.

End view over payoff reels. Machine is compact, only 13′ by 104′.

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This Meaker anodizing machine was built to meet the requirements of the Allmetal Weatherstrip Company. It handles aluminum strip in widths up to 18″, thicknesses from .0071″ to .032″, and at speeds from 2 to 6 FPM. In the illustration above, five strips are running simultaneously at 3 feet per minute, producing a total of 900 lineal feet of anodized and waxed aluminum every hour.

Meaker engineered and supplied this installation complete with every detail, including: a 6000 ampere generator, refrigerating unit, ice bank, hot air blowers, payoff and take-up reel systems, and the Meaker-built anodizing and wax dip unit itself.

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A PLATING MAGAZINE original feature during this observance fiscal year of the FIFTIETH ANNIVERSARY of its parent, American Electroplaters' Society, Inc.

BY YEAR-END 1914, second year of life of the American Electroplaters' Society (AES) as such, Mars had Europe well engripped, and the effects were ricochetting around the world, particularly in still-neutral America. Here, the nation's production efforts were galvanized into feverish action in order to feed, to clothe, to arm the embattled world. In this emergency, many production processes were perfected. Our output consequently doubled and redoubled. And our entrance into the lists of World War I as a combatant in 1917 accelerated even our nation's previous maximum productive pace.

America's state of war naturally slowed down the tempo of AES growth but did not halt it, as the thirst for scientific and technical enrichment continued among those platers and metal finishers who were serving their country in plant or laboratory on the Home Front instead of in the trenches of France or on the high seas of the North Atlantic. Hence, by the time that victory was won and Armistice was signed on November 11, 1918, the AES had increased its Branches to 18 compared with 13 at year-end 1913—these additions being Cleveland and Bridgeport (1914); Toledo (1915); Syracuse and Providence (1916) and Grand Rapids in 1918. Meantime, the Buffalo Branch, born in 1913, had died in 1915.

Within another year, moreover, the AES had chartered still another Branch namely Pittsburgh—and the Providence Branch had expanded its vista by adding Attleboro to its jurisdiction thus becoming today's Providence-Attleboro Branch.

At the Annual Banquet of the thriving Chicago Branch, then-National President Walter J. Fraine described AES progress of that decade thus:

> We can look back over the past ten years and can contrast the conditions prevailing at that time with those of the present. Every one of us realizes that an immense improvement has taken place in processes and methods, and it has largely been accomplished by the thought and work of the members of this Society. Every new process, method and material used has been placed at the disposal of all of our members through the papers of our Branch Societies and our Annual Conventions, adding to our knowledge and usefulness, and raising the standards of electroplating from an empirical art to a profession.

Accordingly, a single decade after genesis as the National Electro-Platers Association of the United States and Canada (NEPA), the AES was already composed of 19 hardy Branches, and its aggregate membership had swelled from 60 Charter Members at birth in April 1909 to some 800 at year-end 1919.

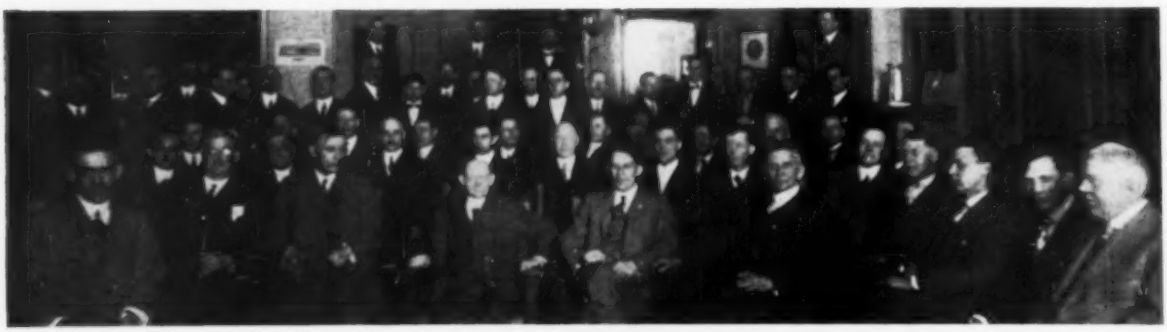
THE frenzied Nineteen Twenties started with depression. By 1920, the population of the United States mounted to over 105 million. A perfected production system able to turn out a vast amount of merchandise existed but domestic distribution, under war restraints, had lagged enroute. Consumers shouted for goods which producers were fabricating in ever-growing quantity during that reconstruction period, but domestic distribution was not yet geared to meet the orgy of demand. Prices skyrocketed as supply trailed demand—and the nation clamored against the "high cost of living."

But time and economic law work in all things. Eventually consumption lagged—finally, all but ceased. Manufacturers were left stranded with huge surpluses—distributors found themselves overburdened with overstock. Result was the depression of 1920-1921.

Despite this bleak post-war background, the AES nevertheless continued its progress. In 1920, it chartered a Reading (Pa.) Branch, and in 1921, it added Branches in Boston, Waterbury (Conn.) and Connecticut Valley (now Hartford). In that same year, it also launched its second Canadian Branch, namely its famed Branch in Montreal. As economic normalcy started its comeback as 1921 turned, therefore, the AES had grown to 24 Branches, these including Toronto and Montreal in the Dominion of Canada.

FROM upturn in 1922 through 1929, the nation experienced one of its most spectacular eras of progress in history to then. Population swelled to over 122 million—national income soared from $79 billion in 1920 to $83 billion in 1929—retail sales from about $35 billion in '20 to over $48 billion in '29—automobile production mounted from about 2 million cars in 1920 to nearly 5 million cars in 1929. There were 60,000 radios in homes in '22—there were 9 million radios in homes in '29. Popularly, the age was labelled "Coolidge Prosperity."

And under the inspiration of Dr. William Blum of the National Bureau of Standards, Past President George B. Hogaboom, Fred J. Liscomb, Thomas F. Slattery and



A meeting of the Detroit Branch about 1918

other AES stalwarts who had done outstanding war work in electroplating, this was also a great pioneering era in AES research.

The National Bureau of Standards shortly after World War I, embarked upon expanded research in cooperation with private industry. The AES was among the earliest to enter into a cooperative relationship with the Bureau for important research work focused upon advancing electroplating and metal finishing. The Bureau provided the equipment, space, supervision, and marshaled, tabulated and made the resultant data available to all concerned. The AES furnished the cost of manpower (one research fellow at start, more later). Dr. Blum was the program's spark and bellwether from origin. The Bridgeport Branch was the first to contribute to the AES's research fund for this purpose.

In order to provide efficient collaboration with the Bureau and Dr. Blum and to establish sound AES direction and coordination over its program, including fund-raising, the AES established its first Research Committee in 1923. In 1925, it called for financial contribution not only from its Branches but also from some 1600 American and Canadian manufacturers. The amount sought was $50 apiece per year. As at May 1926, it had collected $2450.

Among the first organizations to contribute to that first general research fund were the following:

Bell Telephone Laboratories	G. J. Nikolas & Co.
Felt & Tarrant Co.	Canada Cycle & Motor Co.
Oneida Community Company, Ltd.	Wyandotte Chemical Co.
General Motors Corporation	Frederic B. Stevens Co.
Crown Rheostat & Supply Co.	George A. Stutz Mfg. Co.
International Nickel Co.	Westinghouse Electric Co.
American Zinc Institute	The Meaker Company
General Electric Company	Hanson-Van Winkle-Munning Co.

It is interesting to note in passing that these same donors have continously contributed to AES research from then to now, and the many others that came aboard shortly later are in the same general category, namely progressive companies to which advancements in electroplating, metal finishing and allied arts are of "dollars" and "cents" importance.

IN 1919, a woman was granted AES membership for the first time in the Society's history—Miss Esther Zalia Jencks of the National Bureau of Standards. Later that same year, an important event in Miss Jencks' life prompted this poem to be written by H. J. Richards and published in MONTHLY REVIEW:

Our hearts are filled with deep grief,
And crepe hangs on our door;
We've lost Miss Esther Zalia Jencks,
We won't have her no more.

Our roster will not have that name,
From cover unto cover.
The lass has ditched that cognomen
And gone and took another.

May happiness and joy surround
our lady member daily,
The AES sends best regards
to Mrs. Walter Gailey.

Ultimately, Mrs. Esther Zalia Jencks Gailey also won another AES honor, being the first and only woman ever to be elected to the ranks of AES Honorary Membership.

Mrs. Esther Zalia Jencks Gailey
First Female Member of the Society

AT THE AES's Tenth Annual Convention, a sizable enterprise held in Cincinnati in 1922, the Society's Constitution and Bylaws, as rewritten by an appointed committee of Past Presidents, was adopted by the Supreme Society thereby keeping AES laws apace with the times and with AES's progress.

And in 1924 the Society created its Founders Gold Medal to recognize, "the best paper or progress showing a distinct improvement over what was then known in commercial practice." It also launched three prizes (Gold, Silver and Bronze Certificates) to honor top Branch finished product exhibits.

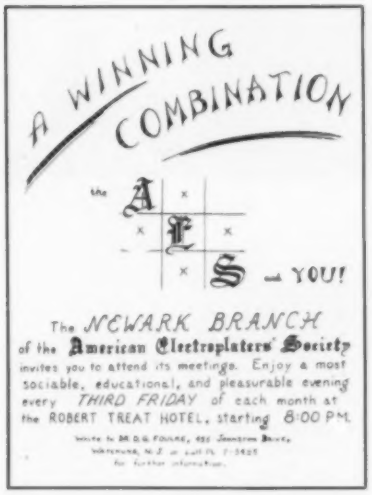
In 1925, a year later, AES journeyed to Montreal for its Thirteenth Annual Convention, the first time that an AES national assembly was ever held outside of the United States.

Though the Society's membership ranks grew during the period from 1921 to 1929, no additional Branches were chartered after 1921 until 1929. Actually, two were lost with the death of the Syracuse Branch in 1924 and the dissolution of the Reading (Pennsylvania) Branch in 1926.

AES spanned the continent in midyear 1929 by the founding of its Los Angeles Branch, a live group with 31 Charter Members at origin. In that same eventful year, it also chartered Branches in Baltimore-Washington and in Worcester, Massachusetts. At fiscal year-end that May 31, its audit statement showed fiscal year receipts of $3,350.30 and disbursements of $3,133.89, with total cash on hand amounting to $2,642.08 represented by a savings account of $2,004.11 and a checking account of $637.94, both in a Bankers Trust Company branch in Philadelphia.

As AES ended two decades of life in 1929, therefore, it was composed of 25 thriving Branches spread coast-to-coast, including two in Canada. It had some 1500 members compared with about 800 in 1919. It was solvent. It was rendering service to its industry, to its members, to the public interest. It had prospects. But ahead also lay the most acute business depression in the nation's entire history.

—JOHN P. NICHOLS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NEWARK PROMOTES MEMBERSHIP INCREASE WITH PLANT POSTERS

Above, the first of two posters provided to industrial companies in the Newark area by the Newark Branch for display by these companies on the bulletin boards of their local plants and elsewhere therein.

"The American Electroplaters' Society", said the Branch in its letter to such companies, "was established fifty years ago for the 'advancement of the science of electroplating and allied arts', and, during this time, the art, as it was known then, has become a science. The AES has been an effective force in this transformation and will continue to provide the means whereby the plater can learn of new developments, new applications of past knowledge and, in general, improved electroplating and metal finishing practices.

"Are your employees, who are concerned with these matters, attending the Newark Branch meetings? Are they members of the American Electroplaters' Society?

"We sincerely believe that attendance at our meetings will prove helpful in a very practical way and urge that the enclosed poster be displayed in your plant. Will you see that this be done and urge your plating people to attend our meetings? We certainly should like to see your company represented regularly."

GRAND RAPIDS READIES GOLDEN JUBILEE ANNUAL

What promises to be one of the best annual educational sessions and banquets ever held by Grand Rapids Branch is scheduled for January 17 at the Pantlind Hotel, Grand Rapids.

Grand Rapids is known throughout the Society for the quality of its technical sessions and the 1959 session certainly will be a rewarding one. Tickets are always at a premium for the banquet—early reservations are in order.

RESEARCH PROGRAM BENEFITTING FROM SPECIAL BRANCH CONTRIBUTIONS

Rochester and Cincinnati are the two Branches that most recently have made special contributions to the AES's vital Research Program over and beyond the "dollar per-Branch member per-fiscal year for Research" paid via Branch per-capita taxes to the Supreme Society.

Rochester's contribution is unique in that it was made in memory of the late Willis M. Fotheringham, a member of the Buffalo Branch, in gratitude for the cooperation that the deceased extended to the Rochester Branch during his lifetime.

Branches that have made special contributions to the Research Program since April 1, 1958 include, beside Rochester and Cincinnati, the Detroit Branch ($100) and Indianapolis Branch ($100).

As manifestation of its interest and confidence in AES Research, the American Society of Testing Materials (ASTM) itself contributed $500 during that same period, its second such contribution since 1956. AES extends its heartiest appreciation.

SYMPOSIUM ON NICKEL PLATING AT CHICAGO

The Chicago Branch annual educational session at the Conrad Hilton Hotel, Chicago, January 31, will take the form of a Symposium on Nickel Plating. The speakers are Myron Diggin, Dr. M. M. Beckwith, Clarence H. Sample and Richard B. Saltonstall. The subjects to be covered are: 1) Nickel Electroforming, 2) Duplex Nickel Plating, 3) Protective Value of Nickel and Chromium in Bright Deposits, 4) Modern Bright Nickel as a Finishing Tool. The moderator will be Simon Gary. Ray Ledford and Christopher Marzano have arranged a fine banquet and top entertainment.

PLATING COURSE MANUAL GOES TO LEBANON

The story of the Newark Branch Electroplating Course written by F. J. La Manna, which appeared in the June 1958 issue of PLATING found an interested reader in far-off Lebanon.

Newark Branch received an inquiry about the course from the Industry Institute of Beirut, Lebanon. G. V. Nash, a metallurgist with the Institute wrote:

"The Industry Institute is a semi-official, non-profit engineering consulting organization and productivity center, set up jointly by the Government of Lebanon and I. C. A. Washington through the United States Operations Mission to Lebanon, and our prime task is to encourage, help and advise local industry."

He further stated, "the electroplating industry of Lebanon, although quite extensive for the size of the country, is very poor . . . it has little technical knowledge and is far away from the guiding hand of the supply houses and technical societies. Practical knowledge is self-obtained and rudimentary. Consequently as part of our program of technological assistance, we are considering presenting a series of talks and discussion periods on the electroplating process."

In conjunction with its course, Newark Branch published an Electroplating Manual. After reviewing the list of contents and the first few pages of the manual sent to Mr. Nash at his request, a copy was purchased for use in his far-away country.

CLEVELAND ANNUAL IN GOLDEN JUBILEE YEAR

Cleveland Branch will hold its annual educational session and banquet on Saturday, Jan. 31, at the Hotel Carter in Cleveland.

The educational session is scheduled to start at 1:30 p.m. Papers will be presented by John A. Swift and Dr. M. H. Jones. "What the Plater Should Know About the Metallurgy and Manufacture of Steel and How These Factors May Affect Plating" is the title of Mr. Swift's paper. He is president of John Swift Chem. Co., Inc. Dr. Jones of the Ontario Research Foundation will speak on "Affect of Basis Metal on Corrosion."

Gordon H. Carlson is the chairman of the Educational Committee.

The banquet will begin at 7 o'clock. Tickets at $8.50 per person are available from Henry Sedusky, 19671 South Lakeshore Blvd., Euclid 19, Ohio. Mr. Sedusky is Banquet Committee chairman.

Kenneth M. Huston

HUSTON HEADS HONORARY MEMBER AWARD COMMITTEE

Past President Kenneth M. Huston of the Baltimore-Washington Branch has been elected Chairman of the AES's recently appointed first Honorary Membership Award Committee. An AES leader at both national and branch levels for many years, with a distinguished record of Society service, he headed the Society in 1947–1948.

AES NEWS

HONORARY MEMBERSHIP AWARD COMMITTEE NAMED

Authorized and instructed by the Executive Board to name an Honorary Membership Award Selection Committee in conformity with the rules for such selection approved by the Supreme Society at its Cincinnati meeting, May 22, 1958, National President Herberth E. Head has appointed four AES stalwarts to that Committee, namely, Past Presidents Charles C. Conley (Detroit Branch) and Kenneth M. Huston (Baltimore-Washington Branch), plus Leslie L. Diveley (Milwaukee Branch) and Louis V. Gagnon (Boston Branch). Messrs. Conley and Diveley accepted two-year terms; Messrs. Huston and Gagnon, one-year terms.

Function of this new Committee is to select nominees for Honorary Membership and Awards of Merit from among candidates submitted, by specified November deadline, to that Committee by Branches through the National Executive Secretary. The Committee's selections are then to have Executive Board approval prior to reference to the Supreme Society at its Annual Meeting for consideration and final action.

BLUM AWARDED ELECTROCHEMICAL SOCIETY HIGH HONOR

First recipient of the American Electroplaters' Society's Scientific Achievement Award, AES's highest honor, Dr. William Blum recently garnered still another "first" by becoming the first winner of the "William Blum Award" of the Baltimore-Washington section of the Electrochemical Society. Dr. Blum achieved that latest honor in recognition of his outstanding contributions to the science and technology of electrochemistry.

The presentation of the "William Blum Award" to Dr. Blum was made at a gala dinner-meeting of the Baltimore-Washington section of the Electrochemical Society that was held November 20, 1958, in Chevy Chase, Maryland.

Dr. Blum will deliver the first "William Blum Lecture" at the opening Educational Session of the Golden Jubilee Convention of the AES at the Statler-Hilton Hotel, Detroit, June 15, 1959.

EIGHT STALWARTS NOMINATED FOR SOCIETY'S HIGHEST AWARD

Seven Branches nominated eight outstanding AES members, within October 15 deadline, for consideration for this year's AES Scientific Achievement Award, the Society's highest honor. These nominations have now been routed by the National Executive Secretary to the Scientific Achievement Award Committee for consideration and selection of this year's winner. The identity of the winner will be announced by Dr. Abner Brenner, that Committee's Chairman, at the Opening Session of the Golden Jubilee Convention to be held at the Statler Hotel in Detroit, Monday, June 15, 1959.

The six-man Selection Committee is composed, beside Dr. Brenner, of Dr. Russel E. Harr, Dr. Louis Weisberg, Dr. Edward A. Parker, Myron B. Diggin and Dr. Samuel Heiman.

Inaugurated in 1958, the first AES Scientific Achievement Award was won by Dr. William Blum who will deliver the first "William Blum Lecture" at the opening Educational Session of the Fifth International Conference on Electrodeposition and Metal Finishing at the AES's Golden Jubilee Convention.

MOTHER BRANCH TO OBSERVE ITS ANNIVERSARY, FEBRUARY 7

A half-century ago next April, AES was born in New York as the National Electro-Platers Association of the United States and Canada (NEPA) with Charles H. Proctor as first president. NEPA was transformed into today's AES in 1913, and its transformation occurred at the first National Convention, an assembly held in New York, June 1 of that year. The late George B. Hogaboom of the New York Branch was named AES's first president.

A New York non-profit educational corporation from its NEPA start, AES first became a New Jersey corporation in 1930.

The New York Branch, AES's "Mother Branch", will observe its Fiftieth Anniversary during AES's GOLDEN JUBILEE with a fitting Golden Anniversary Educational Session and Banquet at the Statler Hotel, New York, Saturday, February 7, 1959.

Officers of today's "Mother Branch" include Dr. Edward Saubestre, president; Joseph Rembecki, first vice president; Jack Wiener, second vice president; Milton Nadel, secretary-treasurer; Anthony Briganti, recording secretary and Arthur Carlson, librarian. Its Board of Managers is composed of George Herrmann, Ralph Ligouri and Albert Fusco.

I send cordial greetings to you and to all of the members of the American Electroplaters' Society as your organization celebrates the 50th anniversary of its founding.

The American Electroplaters' Society can be proud of the many contributions it has made during the past half century in broadening technical and scientific knowledge by fostering advancements in electroplating, metal finishing, and allied arts. The work of its members touches almost every phase of our industrial life involving metal fabrication—everything from guided missiles to safety pins. During the past half century, American Electroplaters' Society has done much to help create better products and an ever higher standard of living.

I wish your Society and all of its members every success in the years ahead.

AVERELL HARRIMAN
Governor
State of New York

AES CONVENTIONEERS TO VISIT MOTORDOM'S BIGGEST PLANT

(1) General Motors Technical Center from under the portico of the Styling Administration Building. Research Administration building and stainless steel tower at far left. Other buildings, l. to r., Service Section, Process Development Staff and Engineering Staff. (2) The Ford Rotunda at the gateway of the Rouge plant. Here the story of progress in the auto industry is told in spectacular displays and murals. (3) Colonial entrance to the Henry Ford Museum. It is an exact copy of Independence Hall, Philadelphia. (4) The 132-foot stainless steel clad water tower near GM's Technical Center. (5) White Hot liquid steel being poured into ingot molds at the Ford Motor steel plant. A dramatic sight. (6) An aerial view of GM's fabulous Technical Center. (7) Aerial shot of the tremendous Ford Rouge plant. The Rotunda can be seen in the foreground.

GOLDEN JUBILEE CONVENTION TO INCLUDE TOURS OF MOTOR KINGDOM'S FAMED CENTERS

The FIFTIETH ANNIVERSARY observance of American Electroplaters' Society, Inc. (AES), now in progress coast-to-coast, will scale the heights of its momentum at the Golden Jubilee Convention and Industrial Finishing Exposition that the AES will conduct in Detroit, June 15–19, 1959 with its Detroit Branch as Host.

Expected to smash all AES National Convention attendance records, this first five-day Anniversary assembly of AES members, their families and guests, including visitors from many countries, will tax to overflowing much of the Motor City's hotel accommodations, including AES's two headquarters hotels, the Statler-Hilton and the Sheraton-Cadillac.

FOR AES GOLDEN JUBILEE DETROIT'LL SHINE IN '59

There will be Anniversary pageantry—and much AES business will be transacted by AES Boards and Committees. The Opening Session is being planned as a dramatic springboard of the Golden Jubilee Convention. The Supreme Society, AES's highest governing council, will meet in legislative session on Monday, June 15 and on Thursday, June 18, with National President Herberth E. Head presiding.

There will be organized breakfasts, luncheons and dinners and other social events plus a full and unusual program of entertainment and athletic events. The Ladies Program being planned is heralded as one of the Convention's brightest features.

The record-breaking number of suppliers' exhibits at the AES's Industrial Finishing Exposition will probably be viewed by the largest audience ever to compose traffic at such an AES exhibition. One of the major points of interest will be the FIFTIETH ANNIVERSARY LOUNGE of the AES itself and of its PLATING MAGAZINE and Research Program.

The Fifth International Conference on Electroplating and Metal Finishing, as the AES's Educational Sessions phase of its Golden Jubilee Convention, will spotlight some two-score technical papers delivered by experts from nine countries ranging from the United States to Germany, from Canada to Australia and India. These will be heard by large audiences of AES members from the United States, Canada and Australia, plus visitors from near and distant lands.

And the Farewell Banquet will be a fitting close to this climax Convention of the Society's FIFTIETH ANNIVERSARY observance.

MOTOR KINGDOM'S ATTRACTIONS TO BE VIEWED

During the Convention, AES members and guests will also have a rare opportunity to visit some of the prominent plants boasted by America's motor kingdom. Though the plans of Plant Visitation Chairman James E. Fritts are still tentative at this writing, it is expected that the fare that his Committee will offer will include visits of both General Motors' world renowned "Technical Center" and the equally famous "Ford Rouge".

FORD PLANT

Ford Rouge at Dearborn is the largest industrial center of its kind in America. From its plant where a record quantity of steel is fabricated to its final assembly lines, it will be a "never to be forgotten" experience to view the activities of that vast fabricator. It is interesting to note that new Fords come off the final assembly line at that plant at the rate of more than one a minute.

GM TECHNICAL CENTER

Technical Center occupies the central 330 acres of more than 900 owned by General Motors at Warren, Mich., north of Detroit. It includes five central staff organizations—Research Staff, Engineering Staff, Process Development Staff, Styling and Technical Center Service Section.

There are 25 buildings, ranging from gatehouses to large laboratory, office and shop buildings. Eleven miles of road circulate through the 330-acre site. Tree-shaded pedestrian walks, as well as underground tunnels, connect major Technical Center groups. There are parking areas for more than 3,600 cars. The lots, situated by each building group, are integrated into the whole campus-like plan. Parking has been divided into small lots to "humanize" them and kill sun reflection. Shrubbery and trees not only screen the areas and shade the cars but also unify the parking lots into the whole plan.

First impression of Technical Center is of a tree-studded campus with low, simply shaped buildings making a pattern of bright-colored rectangles and shining glass surfaces around three sides of a 22-acre lake. The fact that the five central staff operations at Technical Center are separate entities allowed architects to group buildings constellation-like around the 1,780-foot long lake. Each cluster of five staff operation buildings is like a college in a university with its own headquarters or administration building and subsidiary structures.

Just as each of the five automotive divisions of General Motors are highly competitive separate entities, so the central staff operations pride themselves on their individualities. Consequently, each building group—Research Staff, Engineering Staff, Process Development Staff, Styling and Service Section—has been given its own "personality". No building is over three stories high. The anatomy of the plan is: A broad ring of trees around the outside of the 330-acre site; service drive; a ring of parking lots sheltered by trees; the buildings; main entrance drive; broad lawn; the 22-acre artificial lake. The sculptures and paintings at the Technical Center are intended to give delight to the people working there and in various ways to show technology reflected in the creative arts.

From East, West, North, South—from the British Isles and Europe—from more distant places—all roads will lead to AES's Golden Jubilee Convention. And for AES's members and guests, DETROIT'LL SHINE IN '59.

(Left) Detroit, a great port 1000 miles from the sea. Bridge to Canada in background. (Center) Belle Isle, Detroit's famous playground. (Right) Veteran's Memorial, first building of beautiful new Civic Center.

HOST: AES
DIXIE REGIONAL GROUP

INTERIM MEETING REPORTER

DINKLER-PLAZA HOTEL
ATLANTA, GEORGIA
FEBRUARY 14, 1959

TENTATIVE AGENDA
SIXTH INTERIM MEETING
AES SUPREME SOCIETY

DINKLER-PLAZA HOTEL
ATLANTA, GEORGIA
FEBRUARY 14, 1959

1. **Roll Call**
2. **Welcome by the Dixie Regional Group**
3. **Welcome by the National President**
4. **Opening of the Session as an Interim Meeting**
   Purpose of the meeting as a sounding board on matters for subsequent consideration and action by the Supreme Society at its Annual Meeting in Detroit, June 18, 1959
5. **Progress and Status Reports:**
   Financial by President
   Educational by First Vice President
   Membership by Second Vice President
   Constitutional/Bylaw Amendments by Third Vice President
   Honorary, Merit and Achievement Awards by Past President
   Headquarters and Publishing by National Executive Secretary
   GOLDEN JUBILEE:
   a) Convention by General Chairman
   b) Exposition by Exposition Chairman
   c) International Conference by International Council Chairman
   d) Year-long observance by Executive Secretary
6. **Preliminary Reports:**
   a) Appraisal Committee as to the Need for a Long-Range Planning Committee
   b) Appraisal Committee as to the Need for a Convention Planning Committee
7. **Comments and Questions from the Floor**
   a) Membership Promotion (Membership Committee Chairman, Discussion Leader)
   b) Educational Program including Organic Finishing (Education Committee Chairman, Discussion Leader)
   c) Publications Program (Publications Committee Chairman, Discussion Leader)
   d) Research Program (Research Committee Chairman, Discussion Leader)
8. **Consideration of AES's Per-Capita Tax Structure**
9. **New Business Brought for Discussion by Delegates**
10. **Announcement of Candidates for Third Vice Presidency**
11. **Adjournment**

SOUTHLAND TO HOST AES's TWO-DAY GOLDEN JUBILEE DIXIE MEETING

Coupling the Sixth Interim Meeting of the Supreme Society, governing council of AES, with the AES Dixie Regional Group's First Regional Educational Session and Banquet, that two-day event, a FIFTIETH ANNIVERSARY feature, will be held at the Dinkler-Plaza Hotel, Atlanta, Georgia, February 13–14, 1959. An industrious Committee of the AES's dynamic Southeastern Branch is making local arrangements, headed by General Chairman Myron M. Randman, with Past President Frederick Fulforth serving as Coordinator.

Expected to attract the largest number of Branch Delegates in Interim Meeting history to date, the Supreme Society will hold its full day's meeting on Saturday, February 14 with National President Herberth E. Head presiding. Among a heavy Agenda's other business, the Supreme Society will hear the reports of all National Officers. Though the Interim Meeting, under AES law, has no authority to legislate, it will serve as a sounding board on a number of matters likely to appear on the Agenda of the Annual Meeting in Detroit in June. Candidacies for Third Vice President will be announced at the Interim Meeting.

The two-day Atlanta Golden Jubilee event will be launched with an Opening Session, Friday, February 13 starting at 1:30 p.m. That session will immediately be followed by the first of two Educational Sessions arranged by Educational Chairman Jerita D. Wilson. A tour of the Lockheed Aircraft Corporation's famed Georgia Division will be a feature of the forenoon phase of the two-day event.

While Delegates will be attending the Supreme Society meeting all day Saturday, a large number of AES members from Dixie and elsewhere (not Delegates) will participate in Educational Session B to be held Friday forenoon. AES ladies, meanwhile, will be enjoying a number of attractive events specially fashioned for them by Southeastern's resourceful Ladies Committee. The two-day meeting in the heart of Dixie will be climaxed by a reception Saturday evening followed by a gala Golden Jubilee banquet and dance.

The Executive Board will meet in an all-day session on Friday, February 13—then again on Sunday, February 15. It will also meet informally with the Board of Trustees of the Metal Finishing Suppliers' Association, Friday evening.

Three chartered Branches compose AES's Dixie Regional Group namely the Blue Ridge Branch headed by T. R. Boggess, the Miami Branch led by Marmaduke H. Dent and the Southeastern Branch whose Branch President is Claude J. Nalley. Dixie's vaunted hospitality will be in full flower during this two-day AES Golden Jubilee event deep in the realm of King Cotton.

TENTATIVE PROGRAM
SIXTH INTERIM MEETING, SUPREME SOCIETY
and
DIXIE "GOLDEN JUBILEE" REGIONAL MEETING
AMERICAN ELECTROPLATERS' SOCIETY
DINKLER-PLAZA HOTEL, ATLANTA, GA.
FEBRUARY 13-14, 1958

FEBRUARY 12

8:00 p.m.—Registration, Dixie Regional Group, Hotel Lobby

FEBRUARY 13

8:00 a.m.—Registration, Dixie Regional Group, Hotel Lobby
9:00 a.m.—Executive Board Meeting, Executive Secretary's Suite (All Day)
9:00 a.m.—Plant Tour, Dixie Regional Group—(Lockheed Aircraft Corporation, Georgia Division)
1:30 p.m.—Opening Session, Dixie Regional Meeting, Plaza B Room
2:00 p.m.—Educational Session "A", Dixie Regional Group, Plaza B Room
8:00 p.m.—Joint Meeting, AES Executive Board and Board of Trustees, Metal Finishing Suppliers' Association, Executive Secretary's Suite

FEBRUARY 14

8:00 a.m.—Registration, Dixie Regional Group, Hotel Lobby
8:00 a.m.—Registration, AES Delegates/Alternates, Plaza B
9:00 a.m.—Sixth Interim Meeting, AES Supreme Society, Plaza B
9:00 a.m.—Educational Session "B", Dixie Regional Group, Rainbow Roof
12:00 noon—Luncheon, Delegates/Alternates, Sky Room
1:00 p.m.—Sixth Interim Meeting, AES Supreme Society, Plaza B
2:00 p.m.—Annual Meeting, Dixie Regional Delegates, Mirror Room
6:30 p.m.—Reception, Dixie Regional Group, Sky Room
7:30 p.m.—Golden Jubilee Banquet, Dixie Regional Group Rainbow Roof

FEBRUARY 15

9:00 a.m.—Executive Board Meeting, Executive Secretary's Suite.

INTERSOCIETY NEWS

INSTRUMENT SOCIETY ANNOUNCES SYMPOSIUM

The Instrument Society of America will hold its 1959 Fifth Annual Symposium on Instrumental Methods of Analysis programed by the Analysis Instrumentation Division and held at the Shamrock-Hilton Hotel, Houston, Texas on May 18–20, 1959. Dr. J. D. Lindsay, head of Texas A&M's chemical engineering department will keynote the symposium theme "New Techniques in Analytical Instrumentation for Laboratories and for Processing Plants."

Some of the program topics are: Economics of Instrumental Analysis, Electrochemical Methods of Analysis, New Approaches to Instrumental Analysis, Analysis Instrumentation and Computer Control, Instrumentation for Chemical Methods of Analysis, Instrumentation for Optical Methods of Analysis, Instrumentation for Physical Methods of Analysis, New Design Techniques in Process Analysis Instrumentation, Unique Laboratory Instruments for Analysis Instrumentation.

METAL SHOW ATTENDANCE OVER 60,000

Attendance at the 40th National Metal Exposition and Congress was clocked at 60,238, according to Ray T. Bayless, assistant secretary and temporary manager of the American Society for Metals. The Metal Show was held in Cleveland on October 27–31.

As ASM officials shifted their sights toward the forthcoming 11th Western Metal Exposition and Congress next March 16–20 at Los Angeles, there was no doubt of the success of the just-ended National Metal Show. There were 406 exhibitors.

Mr. Bayless reports technical gatherings at the 40th Metal Show and visitor attention established a strong trend of interest in the more exotic metals such as columbium, molybdenum, tungsten and others—and in such revolutionary new techniques as explosive forming.

ASM ANNOUNCES AWARD WINNERS

Three major awards presented annually by the American Society for Metals for service to and achievements in the science of metals and the election of an honorary member have been announced by G. MacDonald Young, president of the 30,000 member engineering society.

Receiving honors at the Society's annual meeting held during the 40th National Metal Exposition and Congress October 27 to 31 in Cleveland were: Dr. Albert J. Phillips, vice president and director of research, the American Smelting and Refining Co., South Plainfield, New Jersey, who received the Gold Medal of the Society; Crawford H. Greenewalt, president, the E. I. DuPont de Nemours & Company, Wilmington, Del., who received the Medal for Advancement of Research; and William G. Pfann, physical metallurgist, the Bell Telephone Laboratories Inc., Murray Hill, New Jersey, the recipient of the Albert Sauveur Achievement Award.

Ernest E. Thum, editor-in-chief of the Society's journal, *Metal Progress*, was selected as an Honorary Member.

All recipients received their honors at the Society's annual banquet October 30 in Cleveland.

INSTRUMENT-CONTROL SOCIETY ELECTS OFFICERS

Members of the Instrument Society of America from across this country and Canada, elected their top officers for 1958–1959 at their recent 13th Annual Instrument-Automation Conference and Exhibit at Philadelphia.

ISA is the nation's only professional and technical society devoted exclusively to all aspects of instrumentation and automatic control. More than 30,000 of the nation's key engineers, scientists, executives and technicians from industry, business and government gathered in Philadelphia for the society's 13th Annual Meeting. The year's foremost event of its kind, this meeting features over 100 top instrument speakers, and the country's largest exhibit and display of instrument and control equipment.

Assuming the presidency of the Society is Henry C. Frost, assistant chief engineer of Corn Products Refining Co., Chicago.

John Johnston Jr., supervisor of E. I. duPont de Nemours' Engineering Service Division's consultation group responsible for instrumentation system development, is the new president-elect-secretary. Mr. Johnston is slated to become president of the Society in 1959–1960.

New vice president of the Society's Standards and Practices Department is Glen G. Gallagher, principal instrument engineer for Fluor Corp., Ltd., Los Angeles, Calif.

PREVIEW OF FUTURE PLATING ISSUES

JANUARY 1959
ABRASIVES AND MECHANICAL FINISHING. Developments in the various finishing methods will be featured in this annual issue.

●

FEBRUARY 1959
A strong issue presenting technical and scientific articles enriching knowledge in electroplating, metal finishing and allied arts, plus general articles of wide readership interest on the Golden Jubilee generally and, particularly, on the AES's SIXTH INTERIM MEETING and its Golden Jubilee Convention and Industrial Finishing Exposition, including the Fifth International Conference on Electrodeposition and Metal Finishing.

●

MARCH 1959
ORGANIC COATING. The importance of organic finishing to electroplaters is increasing rapidly. New and review material will be presented in this third annual edition.

●

APRIL 1959
RESEARCH ISSUE. A feature will be its documentary section embracing the AES's Research Program in American and Canadian universities and foundations, including an historical summary by Dr. William Blum plus a status report on current research projects by AES's current Vice Chairman for Research. Also other technical and scientific papers plus Golden Jubilee news and developments.

●

MAY 1959
PRE-GOLDEN JUBILEE CONVENTION. A larger than usual issue featuring both technical and scientific papers, together with important coverage of Golden Jubilee Convention, Exposition and International Conference news and data of broad readership importance.

●

JUNE 1959
GOLDEN JUBILEE. A unique feature issue climaxing the Fiftieth Anniversary Observance of the American Electroplaters' Society, PLATING's parent, it will be targeted both for immediate interest to PLATING's global circulation and for long retainment as an AES reference source and as a memento of this year-long observance.

INDUSTRY NEWS

NEW SUPPLY FIRM FORMED IN MICHIGAN

A new company, Keystone Plating Supply Inc., has been formed to serve the metal finishing industry in Michigan. Jack E. Keyes and Henry V. Pfeuffer, founders and co-owners, are former sales executives of Wagner Brothers Inc., Detroit.

Among the products offered by the company are Churchill buffs; Promat zinc and cadmium addition agents and conversion coatings; Grav-i-Flo tumbling materials; anodes and other finishing supplies.

Keystone offices and warehouse are located at 21039 Dequindre, Hazel Park, Mich.

WALLACE OPENS EL PASO OFFICE

G. M. Wallace & Co., representatives for Commercial Filters Corp., has opened a new office in the Electric Building, Suite 512, El Paso, Texas. The office is under the direction of B. M. Huffman, a mechanical engineering graduate of the University of Texas, who has had experience in the application of engineered industrial equipment. The Commercial Filters line includes Fulflo filters with Honeycomb filter tubes for micro-clarification of industrial fluids, automatic tubular conveyors, coolant clarifiers and settling tanks.

CASALBI APPOINTS MINNESOTA DISTRIBUTOR

The Casalbi Co., Jackson, Michigan, has appointed Finishing Equipment and Supply Co., 3702 East Lake Street, Minneapolis 6, Minn., as a distributor for that area. They will handle the complete line of Globe barrel finishing equipment and supplies manufactured by Casalbi.

The Finishing Equipment and Supply Co. is a newly formed organization by Win Sabatka and William Bloomquist.

APEX DESIGNS NEW CONTAINER

Celebrating its 25th Anniversary Year of supplying the metals industry with lubricants and cleaning compounds, the Apex Alkali Products Co. of Philadelphia, Pa., is introducing a newly designed, protectively-lined container. This new container is designed in the company colors of red and white and is lithographed with its trade mark.

ALUMINUM COATING WITHSTANDS SEVERE TEST

In May of 1953, a regular section of 3/8 inch 1 x 7 ACCO aluminized high strength guy strand was furnished to one of the country's leading electric utilities for use in a climatically unfavorable service area. The purpose was to submit the strand to severe usage in all types of weather—fog, snow, rain, hail, sleet, corrosive atmospheres, smog, etc.—typical of certain sections of western Pennsylvania and portions of West Virginia.

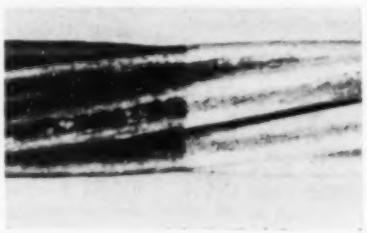


Fig. 1

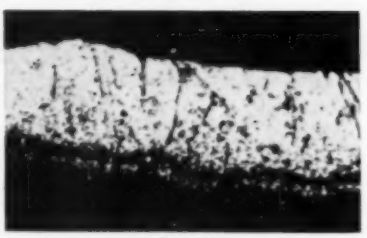


Fig. 2

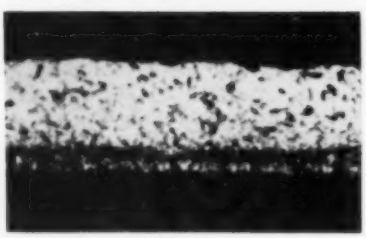


Fig. 3

The guy strand, submitted by the Page Steel & Wire Division, American Chain & Cable Co., Inc., Monessen, Pa., was erected by the electric utility in July of that year. With the passage of time—more than five years of continuous service—officials of the utility and Page Steel & Wire decided to check the installation.

A sample of the guy strand was taken from the excess at the pole and returned to the Page's laboratory for closer examination. Fig. 1 shows the product at approximately two magnifications, both as received and as scrubbed with soap and water. After scrubbing, the bright continuous surface of the aluminum coating is still retained. The dark coloring was due to the formation of an aggregation of sulfide, oxide and soot on the wire's surface during exposure to the high sulfurous atmospheres present in the location during its five years of service.

The guy strand—as erected more than five years ago had a coating weight of 0.27 oz/ft.^{2} of aluminum.

At Page's research and development laboratory examinations of the strand sample secured from the test site, revealed:

Coating Weight:

Outside Wires . . 0.29 oz/ft^2 of aluminum

Center Wire . . . . 0.27 oz/ft^2 of aluminum

Microscopic Measurements:

Microscopic measurements of the coating were made at approximately 500 magnifications. Results are in the photomicrographs of Figs. 2 and 3, taken at 500X.

Page has combined two time-tested, but dissimilar, metals in the production of wire and wire products. Steel is used for the basic strength. Aluminum, for the coating, is applied by a hot-dip method which is covered by United States and Foreign patents

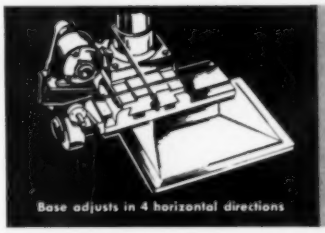
The coating in contact with air has a property of forming a transparent film of aluminum oxide on its surface which controls its behavior in corrosive atmospheres. This oxide film forms almost immediately, when the wire emerges from the molten aluminum bath during manufacture, and is exposed to the atmosphere. At any subsequent freshly exposed surface, due to possible rubbing or abrasive action, the films reform.

STEVENS APPOINTED HYDRA-BLAST DISTRIBUTOR

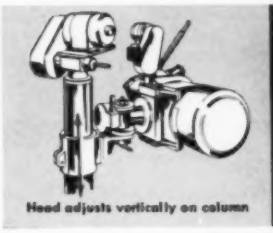
Frederic B. Stevens, Inc., 1800 Eighteenth Street, Detroit, has added Hydra-Blast supplies and equipment to its metal finishing line. Hydra-Blast is a manufacturing division of Automation Services, Inc., of Detroit, Michigan. It produces a wet blasting process wherein water and abrasives are ejected from a blast gun by means of compressed air. This process is used for de-scaling, wet-honing, deburring, blending and cleaning a great many parts manufactured by a wide range of industries.

In addition to Hydra-Blast supplies, the 76 year old Stevens concern will also distribute the automatic or manual equipment used in the Hydra-Blast process.

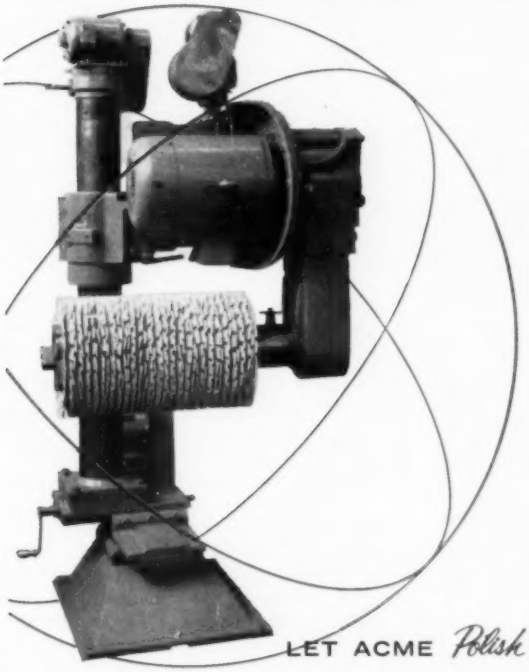
ACME G-4 KEEPS CONVERSION COSTS DOWN!


Base adjusts in 4 horizontal directions

Spindle assembly rotates 360°


Head adjusts vertically on column

Head feed is motorized



If you want machines that will set up for a fast, efficient finishing job on today's work—yet will quickly and easily adapt to next year's designs—ask an Acme engineer to show you the versatile G-4 lathe.

What does the G-4 do? Just about everything! Only four of its many adjustments are illustrated. Without the need for superstructure support, the buffing or polishing head may be faced in four directions horizontally and two vertically. It may be angled to any degree from horizontal to vertical. It may be stationary when it operates, or set for a stroking or oscillating movement. It finishes the most common or the most unusual shapes . . . reduces belt, buffing wheel and compound costs . . . and is ready for adaptation to new designs any time!

An Acme engineering specialist can help you combine these flexible basic units with automatic work-holders or fixtures to give you a set-up for low-cost, high-production finishing. Contact him to discuss your current or anticipated demands. No obligation, naturally.

LET ACME *Polish Off* YOUR FINISHING PROBLEMS

ACME MANUFACTURING COMPANY

1400 E. 9 MILE ROAD, DETROIT 20, MICHIGAN JORDAN 6-1550

LEADING PRODUCERS OF AUTOMATIC POLISHING AND BUFFING EQUIPMENT SINCE 1910

ANADITE OBTAINS HAE LICENSE

Anadite, Inc. of South Gate, California has been awarded the exclusive Los Angeles metropolitan area license on the HAE Process of magnesium by the Western Sealant Metal Finishing Co. of Philadelphia who now holds the patents on the process. The license also covers the HAE color anodizing process of magnesium which, to this date, is still in the research stage. According to Gordon W. Jenkins, general manager of Anadite, Inc., plans are being readied to increase both production and research facilities for magnesium. Some of the missile parts that are now being processed by the HAE Process are: manifolds, covers, caps, housings, yoke assemblies, chassis, dust tubes, brackets, etc.

DU PONT INTRODUCES NEW PROCESS

Development of a technique for cleaning and painting metal parts was announced by the Du Pont Electrochemicals Department at the National Metal Exposition and Congress.

By integrating vapor degreasing with application of paint by flow coating, the new process is claimed to sharply reduce initial investment, operating costs, and floor space requirements compared to present methods of operation. By using the same solvent—nonflammable trichlorethylene—for vapor degreasing and paint thinner, savings inherent in flow coating methods are realized, and flammability hazards eliminated.

Savings of as much as 50 per cent in initial investment and operating cost are possible by use of the trichlorethylene-based system, according to Du Pont's Fred G. Schumacher. Principal savings result from the recovery of over-sprayed paint and volatile thinner. Economies in labor and utilities costs also are effected by combining cleaning, painting, and drying steps in a single machine. All operations are carried out beneath a protective "blanket" of trichlorethylene vapor. Work enters at one end, is cleaned, painted, and removed from the machine free of trichlorethylene thinner.

PLANT MAINTENANCE CONFERENCE IN JANUARY

A broad revision of session topics will feature the tenth Plant Maintenance & Engineering Conference. Almost one-third of the topics to be discussed will be new to the program.

Both show and conference will take place at the Public Auditorium, Cleveland. The show will run for four days, Jan. 26–29, inclusive, and the conference for three days, January 26–28.

Almost 400 companies will demonstrate equipment, services and other products designed to keep plants and machinery in operation at the lowest possible cost. The show is one of the largest annual industrial expositions in the country.

ALLIED RESEARCH CONSOLIDATES BRAND NAMES

Over 100 metal finishing processes, supplies and pieces of equipment of Allied Research Products, Inc., Baltimore, Md., have been consolidated under five major brand names. They are: Iridite for chromate conversion coatings, Irilac for clear protective coating for metals, Isobrite for plating brighteners, ARP designates the process chemicals and supplies, and Wagner indicates the metal finishing equipment. Product brand names are being retained for Flat-top and Lectrocop anodes.

NEW AUTOMATION SERVICES DIVISION

Automation Services, Inc., Detroit, Michigan, announces the formation of its Hydra-Blast Manufacturing Div. Wet blasting, custom designed, automatic and manual machines and process cycles, as well as compounded wet-blasting abrasives and related supplies are the main products of this division. Hydra-Blast products are distributed by Davies Supply & Mfg. Co., MacDermid, Inc., A. T. Wagner Co., F. B. Stevens, Inc., Crown Chemical & Engineering Co., Canadian Hanson & Van Winkle Co., Ltd., and other representatives.

CHEMRAY DISTRIBUTOR FOR STEVENS

Frederic B. Stevens, Inc. of Detroit announces the appointment of Chemray Corporation as distributor for its metal finishing products in the State of Illinois.

Newly founded, Chemray makes its headquarters at 10150 Roosevelt Rd., Westchester, Illinois. It is headed by Ray Ledford, who was formerly associated with Industrial Filter & Pump Mfg. Co. as sales manager. Mr. Ledford is well known in the metal working industry. He is a member of the American Ordnance Association, past president of the Chicago Branch of the American Electroplaters' Society and is first vice president of the Metal Finishing Suppliers' Association.

As distributor for the 76 year old Stevens organization, Chemray will be handling its complete line.

MANUAL AVAILABLE TO BRANCHES

As a reference source to help Branches and Branch officers in effective Branch operation, many dedicated National and Branch leaders collaborated, without any remuneration, in preparing the comprehensive BRANCH OFFICERS MANUAL of the American Electroplaters' Society, embodying practically every conceivable Branch operating subject from membership promotion to Delegates' duties.

Within red covers bound by Chicago screws, this 225-page consolidated mimeographed looseleaf book is now in use in 36 AES Branches that ordered copies.

A limited extra quantity of the book is still available at National Headquarters for the accommodation of Branches that have not previously ordered copies. These will be sold to Branches (only), on a first-come, first-served basis so long as that supply lasts, at $5.50 per copy, including postage to one destination.

Write American Electroplaters' Society, Inc., American Building, 445 Broad Street, Newark 2, N. J. Payment should accompany order to obviate unnecessary bookkeeping expense.

INDUSTRY NEWS BRIEFS

ARMOUR RESEARCH DEDICATES NEW FACILITIES

A $1,200,000 addition to the Metals Research Building at Armour Research Foundation of Illinois Institute of Technology was dedicated Monday, Oct. 20.

The event marked the completion of the second step in a 10-year expansion program by the Foundation. The construction is the 24th new building in the over-all expansion and development program on the campus of Illinois Tech.

Dr. John T. Rettaliata, president of IIT and Armour Research Foundation, presided and spoke at the formal dedication of the building.

Research in the ARF metals department covers the entire scope of metallurgy—from steel-making to nuclear reactor materials—and is conducted in eight sections: applied metallurgy, electrochemistry and extractive metallurgy, foundry and steelmaking, metallurgical processes, physical metallurgy, powder metallurgy, reactor metallurgy, and welding.

PFIZER GRANTED DIVERSEY PATENT

The Diversey Corporation, Chicago, Ill., has announced that Chas. Pfizer & Co., Inc., Brooklyn, New York, has taken a non-exclusive license under Diversey's U. S. Patent No. 2,650,875, covering method of etching aluminum and aluminum base alloys. The license, which extends to Pfizer's customers, also includes certain Diversey Canadian patents relating to aluminum etching.

Diversey's discovery and patent of the usefulness of gluconic acid derivatives with caustic soda solutions in aluminum etching operations led to the development of Aluminux—marketed by Diversey in the United States and Canada.

GRAVER HAS NEW REPRESENTATIVE

Graver Water Conditioning Co., New York, has announced the appointment of G. M. Wallace & Co. as engineering representatives for the Rocky Mountain—Intermountain area. They will handle Graver's complete line of equipment for industrial, utility and municipal water treatment, industrial waste treatment and chemical processing.

Four Wallace offices staffed by a group of power and liquid treatment specialists are located within an area offering convenient service to industry. The home office is in Denver, Colorado with branches in Butte, Montana, Salt Lake City, Utah and El Paso, Texas.

NO RUSTING ON THE MOON

When man reaches the moon, he will find a place where metal never rusts, silver never tarnishes, and bronze never turns green.

This is because the moon has neither moisture, wind, nor free oxygen. There is no atmosphere. These are the main causes of rust on earth, according to Rust-Oleum Corp., Evanston, Illinois, which recently developed a Rust Index of the United States. The moon's Rust Index will be 0.0, the company said, meaning that no rust would ever occur. A better Index number, a spokesman said, would be the Infinity sign.

The rate of rust in the United States ranges from three years to more than 15 years. That is how long it takes in different parts of the country for rust to corrode a steel panel the size and weight of an auto license plate.

Rust is caused by a combination of moisture, wind, corrosive gases, sunlight, and salt water, the company pointed out. None of these is present on the moon, except for sunlight, which alone cannot cause rust. As a result, if man establishes a base on the moon, the space ships that are based there will never rust, the company said.

Better Brass Plating

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There are lots of ways of brass plating. We think we have the simplest way of using True Brite Brass Maintenance Compounds. The performance is something you'll like. In still tanks up to 20 amperes per square foot is easily possible and the same solution will have uniform color even below 1 ampere per square foot. In barrels voltage can range widely without changes in color. All this means fewer troubles.

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If we said you'd never have trouble we would be more than just exaggerating, we'd be plain liars. The only thing we can say is that we've had more experience helping people out of trouble with brass plating than anyone else and somehow we've been able to solve just about every problem that was possible.

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We can supply anodes to suit your requirements. Prices are attractive since it is a primary business with us and delivery is prompt. Both 70-30 and 85-15 analysis are standard alloys.

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PATENT ABSTRACTS

DR. D. GARDNER FOULKE
Manager, Electrochemical Development
Hanson-Van Winkle-Munning Co.
Matawan, New Jersey

Copies of patents may be obtained by writing to Commissioner of Patents, Washington, D. C. Price 25 cents each.

No. 2,842,488, 7/8/58—Metal Electrodeposits—W. Strauss, et al, assignors to Dehydag, Dusseldorf, Germany.

For acid copper plating baths made up from hard water the use of 0.01 to 20 g/l of an N-substituted monoamino compound free of carboxyl groups, along with a sulfonic acid brightening agent is described. Example 2 uses 0.75 g/l of N,N-dipropyl dithiocarbamic acid-n-butylester-ω-sodium sulfonate as the brightener and 2.5 g/l of 2-diethylamino-ethylchloride-1.

11 claims.

No. 2,843,506, 7/15/58—Gas Plating—F. Drummond, Assignor to Commonwealth Engineering, Dayton, Ohio.

Scrap light metal is amalgamated with mercury which is volatilized leaving the porous light metal which in turn reacted to form a heat decomposable compound. The latter is then used for gas plating.

4 claims.

No. 2,843,538, 7/15/58—Leaching Precious Metals—O. Haugens, Oslo, Norway.

The use of an alkali cyanide, hydroxide, lime mixture with electrolysis is claimed.

4 claims.

No. 2,843,541, 7/15/58—Electrophoresis—S. Senderoff and W. Ried of Rocky River, Ohio, and Washington, D.C., respectively.

Metal objects can be coated with barium titinate by forming a colloidal dispersion of ground barium titinate in diethylene glycol, dimethyl ether, 1-nitropropane and pyridine.

9 claims.

No. 2,843,544, 7/15/58—Production of Metallic Beryllium—S. Morana, assignor to the Beryllium Corp., Reading, Pa.

An electrolytic method for forming beryllium dendrites is described.

7 claims.

No. 2,843,979, 7/22/58—Tumbling Barrels—J. Lupo, Mount Vernon, N. Y.

A tumbling barrel with a screen inserted across the center of the barrel is claimed.

1 claim.

No. 2,844,496, 7/22/58—Corrosion Resistant Films on Aluminum—I. Newell, Wethersfield, Conn. and E. Wahlen, Long Meadow, Mass.

A bath for forming corrosion-resistant corrosion films on aluminum contains ½ to 6 oz/gal of a mixture of 5 to 72 parts of sulfamic acid, 1 to 16 parts of an alkali metal fluoride, 0.3 to 34 parts of an alkali metal nitrate and 11 to 80 parts of a chromic acid or alkali metal chromates or dichromates.

18 claims.

No. 2,844,528, 7/22/58—Barrel Plating.—A. Hoffman, Cleveland, Ohio.

A barrel for plating is described with the design such that current flow starts only after the barrel is immersed in the solution and stops at a predetermined time.

4 claims, 7 figures.

No. 2,844,529, 7/22/58—Process for Rapidly Anodizing Aluminum—A. Cybriwsky and N. Mostovyck, assignors to Reynolds Metals Co., Louisville, Ky.

A method of maintaining sheet and strip at a temperature 10F below the anodizing bath temperature is claimed permits higher current density operation.

6 claims, 4 figures.

No. 2,844,530, 7/22/58—Black Nickel Plating.—W. Wesley and B. Knapp, assignors to the International Nickel Co., New York, N. Y.

A black nickel bath is described as containing 60 to 90 g/l of nickel chloride hexahydrate, 15 to 30 g/l of ammonium chloride, 10 to 20 g/l of sodium thiocyanate, 20 to 50 g/l of zinc chloride.

15 claims and figure.

No. 2,845,330, 7/29/58—Method of Recovering Cyanides—W. Zabban, assignor to A. Holden, Detroit, Mich.

The method consists of adding copper sulfate and sodium sulfate to precipitate cuprous cyanide at a *p*H of 6.5 to 7.5.

15 claims.

No. 2,845,376, 7/29/58—Phosphating—M. Hyams, assignor to Nielson Chemical Co., Detroit, Mich.

Claim No. 1 states: "Process of providing upon the surface of metal an adherent coating of insoluble metal phosphate through the chemical action upon said surface of an acidic, water-miscible phosphatising liquid, which comprises providing upon said surface a film of said liquid and subsequently, while said film is still in the liquid state, spraying steam having a temperature in excess of 180F in substantially continuous manner upon the film so provided until the desired degree of coating has been attained, said film being replenished with coating liquid at least once during the period in which steam is applied thereto.

5 claims.

No. 2,845,387, 7/29/58—Electrodepositing Metals.—G. Schnable, assignor to Philco Corp., Philadelphia, Pa.

A method for depositing indium from a molten salt bath containing an indium salt in a valence state below 3, zinc halide and ammonium halide.

14 claims.

No. 2,846,294, 8/5/58—Etching Bath—R. Patterson and Y. Yamada, assignors to Mergenthaler Linotype Company, New York, N.Y.

The bath consists of an aqueous dispersion of nitric acid, from 0.2 to 2.5 per cent of a water soluble salt of tetradicyl sulfate and 1 to 75 per cent of a liquid petroleum fraction (b.p. 70 to 390C.) See also No. 2,846,295, with 19 claims.

19 claims.

No. 2,846,341, 8/5/58—Pickling and Coating Baths, W. Johns and W. Wojtowicz, Assignors to H. A. Montgomery Co., Detroit, Mich.

Immerse the metal in a heated aqueous solution of 5 to 15 per cent of a mineral acid (HCl, H_2SO_4, and mixtures thereof) containing from 2 per cent to saturation of oxalic acid and 0.5 per cent of soluble ferric iron salt.

27 claims.

No. 2,846,343, 8/5/58—Cold Chemical Oxidation of Aluminum—Walter Mason, Minneapolis, Minn.

Claim No. 1 states: "A solution comprising a water solvent, a

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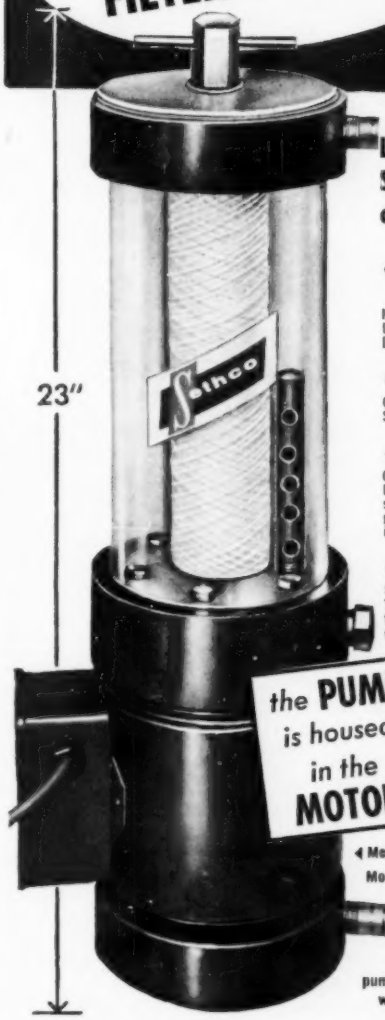

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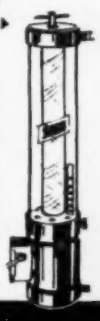

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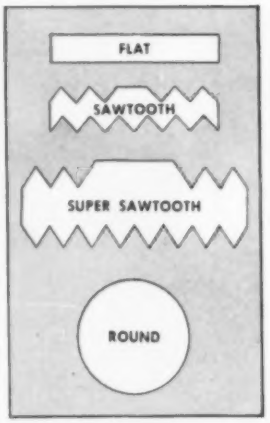

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cupric salt, a copper blackening agent selected from the group consisting of selenium and tellurium, a catalyst, and an acid compatible with the other elements of the solution as an electrolytic agent and capable of dissolving the surface oxide of the surface to be coated with the solution.

13 claims.

No. 2,846,377, 8/5/58—Mold Cavities and Force Plugs—A. Ross, assignor to Jackson Lytle, Baltimore, Md.

An electroforming method is described.

3 claims, figure.

No. 2,846,379, 8/5/58—Plating Equipment for Piston Rings—C. Chambers and R. Spaulding, Assignors to General Motors Corp., Detroit, Mich.

A process and equipment for making split resilient piston rings includes distortion by clamping, then plating.

5 claims, figure.

No. 2,846,380, 8/5/58—Chromium Electroplating—H. Brown, assignor to the Udylite Research Corp., Detroit, Mich.

A compound is described for the reduction of spray in chromium baths as having the formula R_f MSO_3 X where R is a saturated fluorocarbon chain of 3 to 12 carbon atoms. M is a carbon linkage group of 1 to 4 carbons and X is a cation.

7 claims.

No. 2,846,381, 8/5/58—Method of Depositing Smooth Layers of Tin—W. Frick, et al, assignors to Dr. Ing. Max Schlotter, Geislingen, Steige, Germany.

The addition of a flavanol compound to an acid tin bath is claimed.

18 claims.

No. 2,846,759, 8/12/58—Plated Porous Materials—R. Foley and E. Raymond, assignors to General Electric Co., New York.

A corrosion resistant plated porous product is described as an object made of bronze powder impregnated with a 225 Saybolt viscosity oil at 130F and electroplated thereafter with a continuous coating of Sn, Zn, Cd, Cu, Ag and Sn-Zn alloy.

9 claims.

No. 2,847,286, 8/12/58—Forming a Glossy Surface—H. Neunzig, et al, assignors to Vereinigte Aluminum—Werke, A.G., Bonn, Germany.

To form a glossy surface on aluminum, treat the object for 8 to 30 sec at 40 to 90C with an aqueous solution free of ammonium ions containing 1.2 to 9.5 per cent by weight of nitric acid, 2 to 14 per cent of hydrofluoric acid and 0.025 to 0.2 per cent of lead ions.

15 claims.

No. 2,847,287, 8/12/58—Etching Process—C. Landgren, assignor to Bell Telephone Laboratories, Inc., New York, N.Y.

Silicon bodies of p- and n-type can be selectively etched (p-type) in a solution of hydrofluoric acid and potassium permanganate.

8 claims.

No. 2,847,290, 8/12/58—Anti-Slaking Buffing Compositions—B. Marsh and R. Betcher, assignors to Armour and Co., Chicago, Ill.

The compound consists of 65 per cent Vienna lime, 15 per cent stearic acid, 15 per cent acidless tallow and 5.0 per cent of N-tallow-trimethylene diamine.

6 claims.

No. 2,847,320, 8/12/58—Gas Plating with Aluminum—J. Bulloff, assignor to Commonwealth Engineering Co., Dayton, Ohio.

The method for plating aluminum makes use of an organ aluminum halide. See also No. 2,847,319 describing gas plating

of aggregates (15 claims) issued to same company, and No. 2,847, 322 (5 claims) on gas plating silicone treated fibers. Also No. 2,847,330 describing gas plating printed circuits (6 claims).
4 claims.

No. 2,847,321, 8/12/58—Metal Surface Treatment—L. Eubank, assignor to USA (AEC).

A process for coating uranium by immersion on an alkali metal chloride-containing flux selected from the group consisting of alkali metal chloride and a mixture alkali metal fluoride and fluoride, and a mixture of alkali metal chloride and alkaline earth metal chloride.
8 claims.

No. 2,847,327, 8/12/58—Electroless Nickel Plating—P. Talmey and G. Gutzeit, assignors to General American Transportation Co., Chicago, Ill.

Claim No. 1 describes: "The process of chemically plating with nickel a solid body essentially comprising an element selected from the group consisting of iron, cobalt, nickel, aluminum, copper, silver, gold, palladium and platinum, which comprises contacting said body with a bath consisting essentially of an aqueous solution of a nickel salt and a hypophosphite and an additive of the oriented hydrophobic film forming type, said additive comprising a long chain aliphatic organic compound in which the aliphatic radical contains from 8 to 18 carbon atoms, said additive being present in solution in said bath only in a controlled trace amount in the approximate range 5 to 100 parts per 1,000,000 parts of said bath by weight so as not substantially to reduce the plating rate of said bath and so as to inhibit random decomposition of said bath."
11 claims.

No. 2,847,370, 8/12/58—Method of Ornamentation—L. Howard and E. Tyler, assignors to Chas. D. Briddell, Inc., Crisfield, Md.

Mold the design in a plastic article producing ridges and cavities, spray with conductive lacquer, buff off lacquer from high points, plate, abrade to bring plastic and metal portions to a smooth finish, buff and apply a protective coating.
1 claim.

No. 2,847,371, 8/12/58—Chromium Plating Aluminum—P. Topelian, assignor to Tiarco Corp., Newark, N. J.

Prior to chromium plating place the aluminum article in a solution of 3 lbs of CrO_3, 5 gal of 20Bé HCl and 10–20 oz of $CrCl_3$ until gassing occurs.
10 claims.

No. 2,847,373, 8/12/58—Electroplating Zinc.—J. Logan, assignor to Wean Engineering Co., Inc., Warren, Ohio.

The bath consists of

Zinc sulfate	16 oz/gal
At least 1 metal selected from	
Ca and Sr	0.004 oz/gal
A silicofluoride	0.2 oz/gal

High speed plating of strip is described.
4 claims.

No. 2,847,374, 8/12/58—Metal Processing—H. Webster and R. Shoemaker, assignors to Kolane Corp., Detroit, Mich.

Metal parts may be heated in a stress relieving bath containing 75–90 per cent NaOH, 7–13 per cent NaCl, up to 6 per cent NaF, 0.5–5 per cent $NaAlO_2$ and 1–5 per cent of a hydrated hydroxide of an alkali metal.
8 claims.

No. 2,847,377, 8/12/58—Electroplating Rack.—S. Stroinski, Milwaukee, Wis.

Claims a particular type plating rack. See also No. 2,847,378 assigned to R. R. Donnelly and Sons describing a rack for electrotypes (1 claim and figure).
6 claims and figure.

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Photostat or microfilm copies of articles in available magazines may be obtained from: Library of Congress, Washington, D. C.; New York Public Library, New York; Engineering Societies' Library, New York, at prevailing rates. In other cases, consult Wilson's Union List of Serials at your nearest public library for other sources of these articles.

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a. ANODISING BATH FOR MAGNESIUM ALLOYS.
M. W. Davies.
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a. HIGH SPEED BRASS PLATING IN THE PRODUCTION OF BRASS-COATED STRIP STEEL.
E. J. Roehl.
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a. THE NEW TAX LAW AND WHAT IT MEANS TO THE JOB SHOP PLATER.
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140. CORROSION

a. THE CORROSION RESISTANCE OF DUCTILE IRON.
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b. LONG-RANGE FIELD BURIAL STUDY PROBES UNDERGROUND CORROSION.
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b. ANODIZING RACKS TELL LARGE AUTOMATIC: THIS TANK NEXT.
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c. LIGHTING FOR METAL PLATING AND FINISHING.
W. Robinson.
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a. A NEW INORGANIC CEMENT MORTAR FOR SULFURIC ACID SERVICE.
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E. S. Beck.
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b. REINFORCED PLASTICS FOR CORROSION CONTROL.
W. A. Severance.
Corrosion, *14*, No. 10, October 1958, pp. 29–32.

c. MECHANISMS OF WASH PRIMER ACTIONS.
E. R. Allen.
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Ervin C. Tinsley.
Metal Finishing, *56*, No. 9, September 1958, pp. 71–73.

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Products Finishing, October 1958, pp. 42–44.

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Edward R. Jorczyk.
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A. Reymond and Cie., Switzerland.
Electroplating and Metal Finishing, *11*, No. 9, September 1958, pp. 325.

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G. Blet.
Peintures, Pigments, Vernis, *34*,

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April 1958, pp. 160–163.

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b. THE SULPHUR DIOXIDE TEST.
J. Edwards.
Metal Finishing, *56*, No. 10, October 1958, pp. 49–55.

151. THEORETICAL

a. PORES AND PITTING OF PLATED DEPOSITS.
Dr. J. M. Odekerken.
Metal Finishing, *56*, No. 10, October 1958, pp. 64-66.

b. PROCESSES OF ELECTRO-CHEMICAL CORROSION.
G. V. Akimov.
Corrosion, *14*, No. 10, October 1958, pp. 33–53.

152. WASTE DISPOSAL

a. RECOVERY OR DISPOSAL OF PLATING WASTES.
R. J. Keating.
Metal Finishing, *56*, No. 9, September 1958, pp. 46–48.

b. DESTRUCTION OF CYANIDE WASTES BY ELECTROLYTIC CHLORINATION.
J. T. Bryne, W. S. Turnley, and A. K. Williams.
Journal of the Electrochemical Society, *105*, No. 10, October 1958, pp. 607–609.

The following are metallurgical abstracts taken from The Journal of the Institute of Metals, July 1958, pp. 870 and 871.

Throwing Power in Efco-Udylite Bright-Nickel Solutions. P. Meuldijk Metal Finishing, 1957, (N.S.), 3 (36), 491–492, 494). Laboratory tests are described on (a) 3 dull-Ni, a dil. soln. and both the SO_4^{2-} and Cl^- soln. without any addn. agent designed to give some idea of the influence of the inorganic components on throwing power (T); (b) the Udylite 514 soln. in which the components of the soln. were added one after the other and T values calculated; (c) the influence of contaminants such as Zn, Pb, grease etc. on T in the Udylite 514 soln.

The Influence of Materials Containing Divalent Sulfur on The Process of Nickel Plating. A. V. Pamfilov and R. M. Morgat. (Ukrain. Khim. Zhur., 1957, 23, (5), 684–688)—(In Russian)—It was shown that materials contg. S as sulfide result in the brightening of deposited layer during the electrodeposition of Ni. An hypothesis was put forward for the mechanism of the action of such addn., based on the protective influence of colloidal NiS in the process of electrolysis. Brightness is increased with reduction in acidity because an increase in acidity has an adverse effect on the formation of coloidal NiS. No connection between acidity and polarization was found.

The following are metallurgical abstracts taken from The Journal of the Institute of Metals, August 1958, pp. 929–930.

Production and Properties of Opaque Coatings by Chromic Acid Anodizing. A. W. Brace and R. Peek (Light Metals, 1957, 20, (230), 166–167)—Results of research are reported into the effect on film thickness and degree of opacity of varying the voltage, temp., and concentration of the CrO_3 bath. The optimum conditions give an almost white, opaque film on commercial-purity metal and most alloys, which can be successfully dyed.

Here Are Ten Steps in Black Anodizing Aluminum Die-Castings—(Precision Metal Moulding, 1957, 15, (11), 56–57)—The sulfuric Alumilite process as used for ASTM.-B85, SG 100A, and S12B alloys for railway signalling parts is outlined. The steps are: shot-blasting, vapour-degreasing, anodizing (producing films 0.0004 in. thick), rinsing, black dyeing at 150F (65C) and *p*H 5.8–6.2, rinsing, sealing in Ni acetate soln., rinsing, air drying, and buffing.

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L—1201. Phosphating Analysis Kit—Development of a phosphating analysis kit that enables metalworking manufacturers to determine whether their products are adaptable to phosphating and to the many paint adhesion advantages it offers has been announced by Turco Products, Inc.

The kit is offered free of charge to any manufacturer in the metalworking field, whether or not he is currently phosphating.

L—1202. Brushes—The Osborn Manufacturing Co. announces the availability of a new eight-page booklet, two color, titled, "Osborn TY Tools, a new concept of brushing tools for power finishing."

The booklet tells the new TY brush story. It shows the various designs and applications of this new brush.

The TY Brush extends the basic principles of power brushing into new fields of power brush usage. Many manufacturing operations that utilize such tools as rotary files, abrasive stones or belts, tumbling and shot blast machines, are said to be economically and efficiently accomplished with this new TY brush. This booklet shows typical applications of the new brush, and specifications.

L—1203. Air-Cooled Metal Center Buff—An eight-page color folder on a new air-cooled metal center buff-called the Red-D-Vent—has been issued by Divine Brothers Co.

"Red D" Buff has been improved in construction and a metal center designed to fit the buff, the announcement said.

Made from various types of selected cotton sheeting, cut on the bias to provide the most effective cutting face and exposing the maximum number of thread ends to the work surface, the buff's ability to retain composition has been increased.

Containing the new metal centers, the new buffs run cooler and last longer, it was maintained.

L—1204. Dip Tanks—Four standard models of all-steel dip and rinse tanks for precision finishing processes are outlined in a new bulletin released by Techline Division of Wheelabrator Corp.

Two water tanks and two oil tanks are pictured in the bulletin. They are of double-wall construction, 40-gal maximum capacity and come equipped with sliding covers to protect solutions and electrical heaters, according to the bulletin.

L—1205. Non-Flammable Solvent—An illustrated, two color, twelve page booklet describing Immunol, non-alkaline, non-acid detergent and rust preventive that cleans degreases and rustproofs metal in one operation has recently been published by Harry Miller Corp. The booklet describes how non-flammable Immunol eliminates the fire hazard; replaces certain types of soaps, alkalies and solvents; eliminates the problems of dermatitis, toxicity and skin irritations; is odorless, neutral chemically and inexpensive since only a few ounces per gallon of water produce a gallon of solution that can be used over and over again once foreign matter has been removed. The product, which can be applied by wiping, dipping or spraying, is said to mix with hot or cold, hard or soft water.

L—1206. Aluminum Processing—Products and cleaning procedures for aluminum processing is the subject of the new colorful folder "Works Wonders with Aluminum," released by J. B. Ford Division, Wyandotte Chemicals Corp.

Etching, cleaning before anodizing, desmutting, paint stripping, barrel finishing, deoxidizing are among processes described.

Featured for decorative and deep etching, scale and sludge control, is Wyandotte Mil-Etch; also, Altrex, non-etching heavy duty soak cleaner; Wyandotte 2487, desmutter and deoxidizer; Wyandotte Phos-It for paint preparation and brightening.

L—1207. Plating and Processing Machine—New four-page Bulletin U-658, available from The Meaker Co., describes the new Uniline single row plating and processing machines. Complete machine is illustrated and described with emphasis placed on the carriers, main frame and ultra smooth . . . positive drive. Folder also illustrates and lists other types of Meaker machines for plating, etching and anodizing, pickling, phosphatizing and related processes.

L—1208. Carbon and Graphite—Description of its complete line of carbon, graphite and impervious carbon and graphite equipment for chemical processing applications is available from National Carbon Co., Division of Union Carbide Corp. The 4-page illustrated bulletin discusses each of a wide range of products, and refers to specific catalog sections that contain complete technical data.

The equipment described includes shell and tube heat exchangers; cascade, concentric and immersion type heat exchangers; centrifugal pumps; pipe and fittings; towers and accessories. Other products discussed are anodes and backfill for cathodic protection; electrolytic anodes; and activated carbon. Phosphoric acid systems; sulfuric acid diluting equipment, pump injectors and ejectors; and porous carbon and graphite are described and falling-film type hydrochloric acid systems are discussed in considerable detail.

L—1209. Brush Plating—The twelve page booklet entitled "Practical Brush Plating with the Dalic Process" has been reprinted and is again available for distribution by Marlane Development Co. The booklet describes the process in detail and gives photographs and descriptions of numerous engineering applications for high speed brush plating.

L—1210. Reverse Current Cleaner—Oakite Composition No. 195, a new, non-etching reverse current cleaner, is described in a folder, F10466 recently published by Oakite Products, Inc.

The folder points out that testing of the new compound has demonstrated its ability to remove soils without darkening the zinc or changing the color achieved in preceding buffing operations. Another advantage described by the folder is the material's usefulness in cleaning not only zinc, but brass, copper and steel, all in the same solution.

L—1211. Coatings—A new 36 page brochure on clear and colored "Coatings" for use on metal, plastics, glass and wood has been published by the Bee Chemical Co.

Information on numerous coatings for application to the various surfaces by spraying, screening and roller coating is provided. Data is given on standard colors available including metallics, bronze-less gold and other special effects. Information relating to the application of coatings of special interest to those who use or specify coatings is also included.

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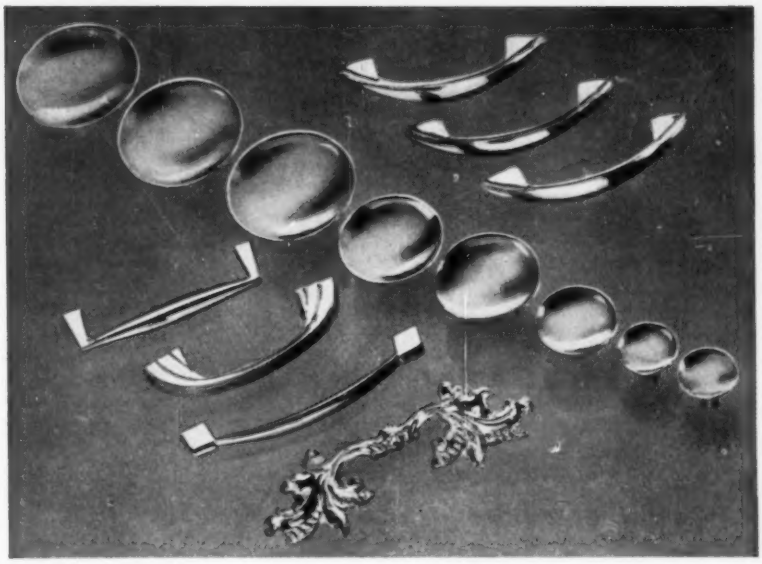

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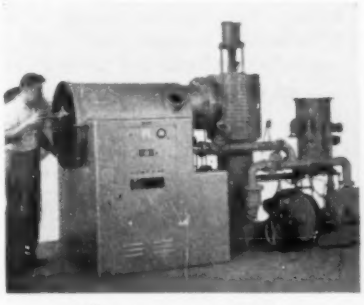
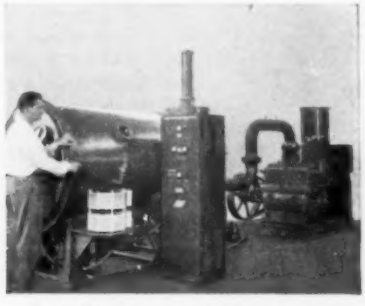


30" coater—model LCI-30

Typical production: 400 1½" diameter pieces per cycle; 5 to 7 cycles per hour.



48" coater—model LCI-48C

Typical production: 1450 2½" diameter pieces per cycle; 3 to 6 cycles per hour.

Consolidated Electrodynamics

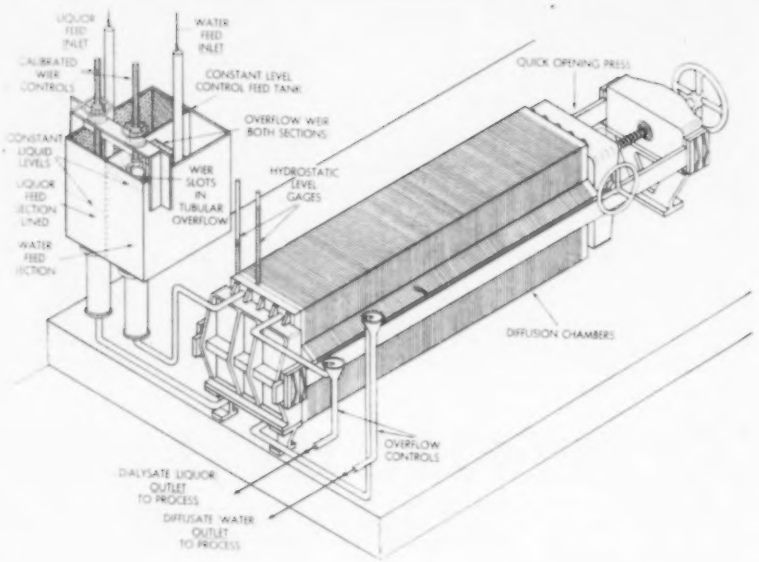
Rochester Division, Rochester 3, N. Y.

SALES AND SERVICE OFFICES IN PRINCIPAL CITIES

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 1232.

EQUIPMENT AND SUPPLIES

Use the convenient Reader Service Card to obtain additional information on any of these items



E—1200. Dialysis System—Development of dialysis equipment for the separation of acids and other chemicals from solution has been announced by Graver Water Conditioning Co. The new dialysis system is known as the Hi-Sep Dialyzer (for high-rate separation) and contains the first acid-resistant membranes.

The Graver membrane is made of a new type of synthetic resin which is said to be so tough that it will operate for a long time without requiring replacement, repair or cleaning. Thus, instead of requiring neutralizing equipment and chemicals for the discharge of acids to waste, industries using acids in processing can now obtain equipment for recovery of acids that can be reused in processing.

The new membrane makes possible a wider use of dialysis than was previously known. Dialysis is a diffusion process whereby specific molecules in a liquor can be separated by being passed through a semipermeable membrane. In this way, either purification of the liquor or recovery of the acid can be accomplished.

Among the chemicals which can be recovered by Graver's Hi-Sep Dialyzer are sulfuric, hydrochloric, nitric, chromic, phosphoric and acitic acid. Before the development of the acid-resistant membrane, caustic soda recovery was the only established commercial application of dialysis.

The unit is an integrated system with head tank and flow regulators. It has an exclusive feed control which maintains a constant head.

Operation of the system is by gravity and no power is required except for pumping liquids up to the head tanks. The system operates on a continuous basis and once it is started, very little supervision is required.

It has a filter press type design. It is composed of alternate liquid and water cells in upright frames with each cell separated by a semipermeable membrane sheet. The frames have "ears" that rest on two horizontal bars of the press.

The frames are of plastic and have ports. These are adjacent to each other in the press and act as conduits for the counterflowing liquid and water feeds.

E—1201. Low-Sludge Nickel Anode—Recessed surfaces are easier and less expensive to nickel plate with anodes cast as a new low-sludge alloy which have been introduced by Hanson-Van Winkle-Munning Co. The new material corrodes evenly, producing minimum metallic and carbon sediment. No anode bags are required. Patent applications have been filed.

The company reports successful results after test marketing Lo-Sludge nickel anodes. Substantial markets for the new alloy are anticipated in the form of auxiliary anodes used to plate bright nickel areas of low current density. Automotive design offers numerous opportunities in this category in the form of surfaces that cannot be given a thick coating of bright nickel by conventional processes.

E—1102. Relay Tester—A new, versatile relay tester designed to check the accuracy and response of devices used to protect electrical equipment, also provides infinitely variable ac voltage—0–115 v—for laboratory or maintenance service. Known as the Vari-Pac Tester, the unit, available from Sel-Rex Corp., is contained in a magnesium "suitcase" and weighs 41 lb, according to the manufacturer.

Among the devices the Vari-Pac tester will "check out" are: relay for circuit breakers, overload relays, circuit breakers, and a wide range of time-versus-current devices—both new and obsolescent.

The main output circuit provides the following continuous ac rating: 0–4 v/100 amp; 0–8 v/50 amp; 0–16 v/25 amp; and 0–32 v/12.5 amp, with 115 v, 60 cycle, single phase input. The secondary output circuit offers a convenient source of infinitely variable ac voltage.

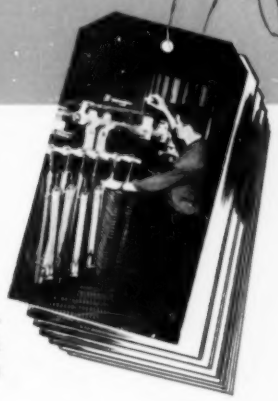
E—1203. Hard Chrome Package—The George L. Nankervis Co. has introduced a new precision hard chrome plating package. Called the Nankervis Hard Chromer, the unit provides a complete on-the-spot facility for precision hard chrome finishing of tools, gages and other parts. A key feature claimed of the unit is that it enables plating to within .0001 in. eliminating the need for expensive grinding operations after plating, usually required. The package consists of tanks, rectifiers, automatic heating elements and controls.

The hard chromer is completely self contained, is said to be easy to install, and can be operated by relatively unskilled personnel. The unit is delivered ready for immediate connection to water, power and drain.

It can plate in grooves, recesses, shoulders and at the same time maintain sharp, clean corners, necessary for thread gauges, taps and drills, etc. The plate is claimed not to chip, flake or spall.

From H-VW-M

10 important ways to keep metal finishing costs down



All the processes, supplies and equipment in H-VW-M's line have been designed for maximum efficiency and cost savings. But among this full line are a group of products and processes which – if they apply to your operations – can offer outstanding costs and labor saving advantages. Included in this group are high-efficiency electrical and processing equipment, unusual processes, and finishing supplies having unique advantages.

The scope of the exceptional H-VW-M products, described on the following pages, covers a wide range of plating and finishing operations of every type, and the likelihood is strong that several, or perhaps all, are applicable to your plating plant. By investigating all of them, you should strike just the process, equipment or supplies you need to effect very real economies in your operations.

HANSON-VAN WINKLE-MUNNING CO. MATAWAN, NEW JERSEY U.S.A. SINCE 1820

HANSON-VAN WINKLE-MUNNING COMPANY

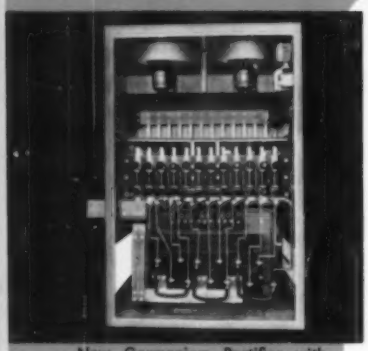
MATAWAN, NEW JERSEY

Manufacturers of a complete line of electroplating and polishing processes, equipment and supplies

PLANTS: Matawan, N. J. • Grand Rapids, Michigan • Los Angeles, California (Alert Supply Co.)

Sales Offices: Anderson (Ind.) • Baltimore • Beloit (Wisc.) • Chicago • Cleveland • Dayton Detroit • Grand Rapids • Los Angeles (Alert Supply Co.) • Louisville • Matawan • Milwaukee New York • Philadelphia • Pittsburgh • Plainfield (N. J.) • Rochester • San Francisco (Alert Supply Co.) • Stratford • Toledo • Utica • Wallingford (Conn.) • West Springfield (Mass.)

10 important ways to keep



New Germanium Rectifier with panel removed to show simplified construction.

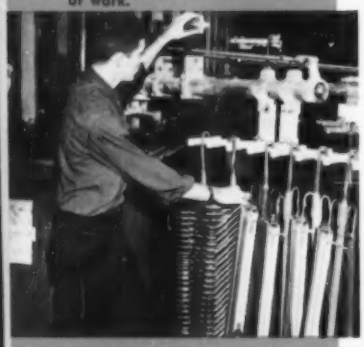
Manual Tap Switch Control

Motor Operated Tap Switch Control

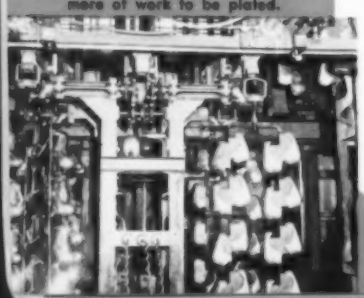
Continuously Variable Auto-Transformer

Saturable Core Reactor

Operator is shown adjusting the Dial-A-Cycle mechanism that will determine the cycle for this rack of work.



Automatic loader-unloader has just removed two racks of plated bumper guards and loaded two more of work to be plated.



ELECTRICAL AND PROCESSING EQUIPMENT

GERMANIUM RECTIFIERS

H-VW-M Germanium Rectifiers, known for efficiency, operating economy, compactness and close voltage control, are available in 6 to 150 volt capacity, with current outputs from 500 to 10,000 amperes. Designed for 24-hour-a-day operation at full capacity, with outputs of 12 volts or more, they have efficiencies up to 92%. Exceptional efficiencies are attained at ¼ and ½ loads. Voltage regulation as low as 5% can be obtained from no load to full load on some models at voltage ratings of 20 volts and above. Available with various types of voltage controls, manual or automatic, in self-contained or remote-controlled models.

Also look into the revolutionary new low cost line of Powertron Germanium Rectifiers—an H-VW-M first—with exclusive new features. These include: no-fuse DC protection system, no paralleling of junctions, high efficiency and improved regulation of germanium, 44 control positions with range of 2 to 12 volts, and less than 5% ripple. Available in ratings of 750 amperes, 1500 amperes, and 3000 amperes. Something special in packaged units and you get all the advantages at a new low price. If one of these fits your plating requirements, then you've got a real bargain. Immediate delivery. Write for catalog.

RECTIFIER CONTROLS

H-VW-M offers a complete line of rectifier controls to provide for many control functions. Used with either selenium or germanium rectifiers, these controls, properly applied, permit the most efficient control possible. Such devices as manual and motor operated tap switch controls, continuously variable auto-transformers and saturable core reactors are used with or without supplemental controls to provide automatic voltage stabilization, automatic current stabilization as well as automatic programming. H-VW-M Bulletins ER-108 and ER-109 further explain economical H-VW-M Rectifiers and Controls. Write for it.

FULL AUTOMATIC CONVEYORS

For well over 30 years H-VW-M design engineers have worked continuously for improvements in the automatic conveyors for electroplating and allied operations in which H-VW-M pioneered.

Today's full-automatic conveyors are a far cry from the conveyors produced by H-VW-M as early as 1922. But one thing remains the same—and that is H-VW-M's desire to provide the most advanced and efficient equipment possible. Scores of innovations and improvements resulting from continuing H-VW-M research mean today's H-VW-M Full Automatic Conveyors offer the ultimate in service and efficiency for peak production of the highest quality at lowest cost.

DIAL-A-CYCLE CONTROL

Exemplifying the many H-VW-M developments contributing better, easier plating, is the remarkable new DIAL-A-CYCLE Control. This unique selective by-pass mechanism—of particular interest to aluminum anodizers—permits a whole series of different operations and cycles in one full automatic conveyor. Length of any treatment time can be varied, and, in anodizing, different colors can be anodized in one continuous operation, and in any sequence. It is a truly revolutionary device, resulting in remarkable labor savings and increased production.

AUTOMATIC LOAD-UNLOAD

Automatic Load and Unload is another recent development of H-VW-M that contributes to greater economies in the plating room. This new transfer unit, operating the same indexing sequence between plating conveyor and a monorail conveyor loads and unloads racks automatically. Manual handling is eliminated by this major advance towards automation in metal finishing.

This, of course, is just one of many types of conveying equipment offered to metal finishers. Return type conveyors, elevator conveyors, high-lift conveyors, straight line conveyors, and others—of every description are H-VW-M designed, manufactured and installed. If you'd like to know more about the cost-saving story of H-VW-M Full Automatic Conveyors, write for Bulletin FA-105.

metal finishing costs down

BUFFING AND CLEANING SUPPLIES

BUFFS

Tufta-Flex and Sisal-Flex Buffs

Speed and economy are embodied in two new H-VW-M Buffs for thorough cutting and coloring on contoured surfaces. For medium and heavy duty, SISAL-FLEX Buffs with sisal-cored tufts are available, and for light to medium duty, TUFTA-FLEX Buffs, having full cloth tufts, are offered.

Both buffs feature double-folded tufts for maximum cutting surface, and to retain compound on the leading edges and ends of the tufts. To prevent streaking, tufts are staggered in a double row around the buff. Cool running, a feature of both buffs, is the result of staggered tufts, plus a pattern of ventilating holes in the rugged steel center. Fraying, which is wasteful and expensive, is ruled out by the bias-cut construction of both cloth and sisal.

These time and cost-saving new buffs are available in standard diameters from 12 to 18 inches.

BINDERIZED® RUFF-L-BUFFS

"BINDERIZED" Ruff-L-Buffs are pre-treated with a high quality compound binder. Because every fibre is impregnated with the same binder used in buffing compounds, Binderized Ruff-L-Buffs are ready for operation at top efficiency from the very first piece.

The cost-saving advantages of Binderized Ruff-L-Buffs are many. "Heading-up" is eliminated, thus break-in time is radically reduced. Because of the natural affinity between the Binderized Ruff-L-Buffs and the compound, the compound lasts far longer, and is easier to apply. Naturally, much better cut is obtained because of the high amount of compound carried.

Perhaps the greatest advantage of Binderized Ruff-L-Buffs is their internal lubrication which prevents wear inside the buff (see photos). Wear is even—and up to 30% longer. To learn more about the unusual economies of Binderized Ruff-L-Buffs, write for Bulletin No. B-103.

Plain Ruff-L-Buff (below) after wearing off 1 inch in test. Loose threads, numerous holes and breaks due to excessive heat and abrasion are apparent.

Binderized Ruff-L-Buff (below) after same test. Notice absence of thread or cloth breakage, convincing proof of Binderizing's effect on buff life.

LIQUIMATIC COMPOUNDS

and application equipment

Buffs "live" up to 200% longer . . . No compound waste . . . Reduced labor costs . . . Fast cutting, easy cleaning—all these advantages and more are embodied in the unusual Liquimatic Liquid Compounds and application equipment.

Because of the enormous economies of using the Liquimatic System, the system soon pays for itself in buff, compound and labor savings.

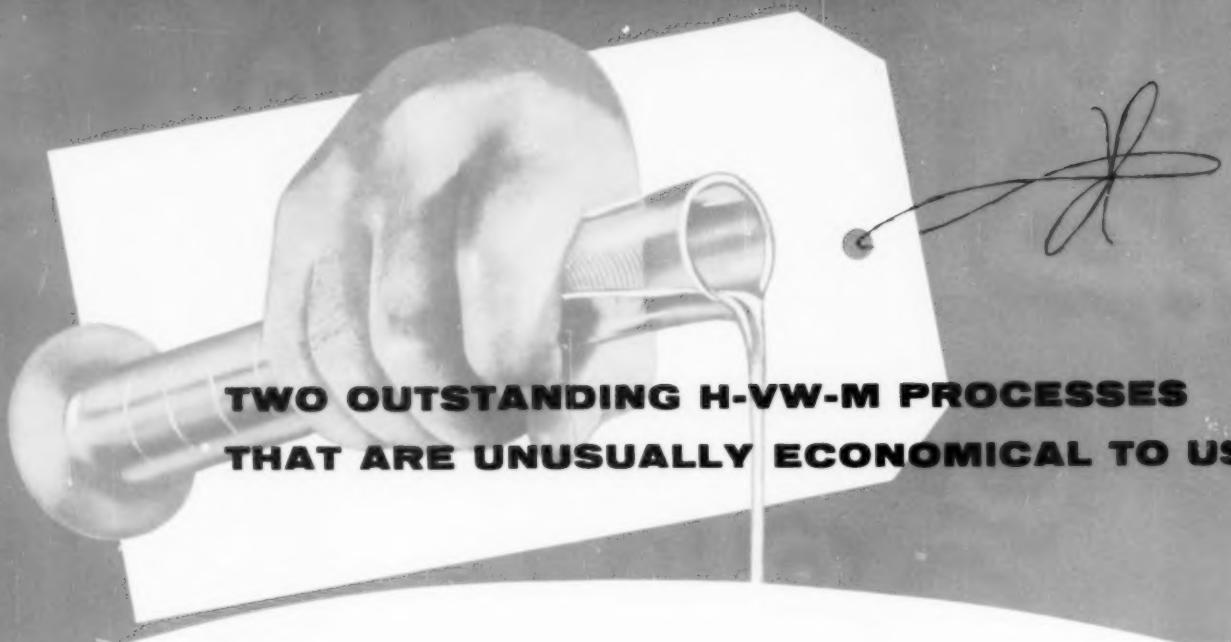
A complete line of Liquimatic Compounds is available for cutting and coloring ferrous and non-ferrous metals. These provide an adhesive, slow-wearing buff face, and have a high safety factor because of their high flash point. All are of sprayable viscosity, and have a long storage life. Write for H-VW-M Bulletin No. Co-103, which fully describes Liquimatic and other economical H-VW-M Compounds.

85-S ALUMINUM CLEANER

H-VW-M devotes constant research to the subject of cleaners and the result is a comprehensive line of Matawan Cleaners giving superior results in soak cleaning, power spray operations, oxide removal, and special cleaning and etching operations.

Of particular importance is H-VW-M's new 85-S Aluminum Cleaner, which offers interesting advantages to aluminum finishers. It prevents scale formation, for instance, thus keeping coil and tank walls scale free, and it leaves an extremely bright surface. Its built-in regenerator makes maximum effective use of caustic in the bath.

H-VW-M Bulletin C-108 tells about this unusual cleaner, and other Matawan Cleaners offering unusual money-saving advantages.



TWO OUTSTANDING H-VW-M PROCESSES THAT ARE UNUSUALLY ECONOMICAL TO USE

LEVELUME

H-VW-M's new LEVELUME represents a milestone in nickel plating processes. It is the first bright nickel process to combine qualities of full brightness, high leveling and exceptional speed. In high-production installations, deposition rates with LEVELUME are 100% higher than those obtained with any other process, but will require some air agitation equipment.

Conversion to Levelume is simple, involving no new investment in conveyors, or tanks.

Key to the new process are its addition agents. With them an activated carbon pack can be used in the plating solution filter. This constantly removes harmful organic contaminants, preserving the purity of the bath, and consequently contributing to the economy of the process.

A few of the additional benefits include high surface activity, good ductility, controlled stress, and the feasibility of double coatings. A full description of the process–one in the family of NICKELUME processes – is available in the Levelume Manual, which is available on request.

CADALUME

H-VW-M's New Cadalume Process has all of the extras that you have been looking for in cadmium plating. It is the newest and best answer because it does the job faster and better. The new improved Cadalume Process of H-VW-M *lets you get at least 80,000 ampere hours for every gallon of brightener consumed. And bright dipping is eliminated for most applications!* The secret? It's simply this: You use two different Cadalume Brighteners. One is the Cadalume Make-Up Brightener and you use it only when you make up a new bath or convert an existing one. The other —Cadalume Brightener—is the strong addition agent used for all maintenance.

Here's why Cadalume keeps your costs low: The bright range is increased up to 10% . . . you get very high plating speeds—up to 10% increase . . . 4 times longer bath life . . . better distribution . . . and the brightener is more stable—it won't plate out. This simple, easy-to-operate economy is something for you to see. Ask for the New Cadalume Technical Manual.

H-VW-M PROCESSES, SUPPLIES AND EQUIPMENT KEEP PLATING ROOM COSTS DOWN . . .

They're Always Your Best Buy!

HANSON-VAN WINKLE-MUNNING COMPANY

MATAWAN, NEW JERSEY

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E—1204. Diffused Junction Silicon Rectifiers. A new series of diffused junction silicon rectifiers will provide currents up to six amp over an inverse voltage range from 50 to 500 v. These units, manufactured by International Rectifier Corp., are operable at diode base temperatures up to 150C.

To provide optimum reliability over their working temperature range, these hermetically sealed units feature an all-welded construction that is completely free from flux material. In addition, each unit is nickel-plated to provide minimum contact resistance and prevent corrosion.

E—1205. X-Ray Fluorescence Analyzer—The Quantrol is an x-ray fluorescence instrument designed by Applied Research Laboratories for continuous stream monitoring of a solid, liquid or powder directly on the production line. The instrument may be so placed as to look at a tin-coated strip moving under it at high rates of speed, and record the thickness, or coating weights, continuously as the material passes by. Use of the ratio technique makes this instrument practical as a production control device.

E—1206. Water and Oil Absorbent—The announcement of an anti-slip absorbent for oil, grease and water deposits is announced by The Bares Co.

This product, called Soakup, is reported to be able to absorb 425 per cent of its weight in oil alone. It also has the ability to completely dissolve all residual oil films when water is added to it. The material is an aluminum silica in calcined form, and is inert and sterile. It is said to be able to soak up oil, water, grease or acids instantly, and can be swept up immediately after applying to the material to be soaked up. If left on the floor, it will not become soggy, heavy or muddy, and is non-slippery and skid-proof.

E—1207. Cooling Units—Complete packaged chilled water or acid cooling units are designed and manufactured by Kol-Flo Kooler Co. for pre-cooling and temperature controlling of plating, anodizing and chemical solutions. All Kol-Flo plating cooling solution units have completely insulated chillers as well as the cold coolant lines; enclosed control panel containing fully wired operating and safety controls for maintaining precise temperatures of bath solutions.

The components include a complete Freon refrigeration system, chiller, automatic electrical controls, internal piping and wiring.

Unit is completely automatic, instant cooling and temperature controlled.

They are available in sizes from 1 to 100 hp. Chillers are manufactured in copper for cold water recirculation cooling and stainless steel or lead for direct acid solution cooling.

ORIGINAL

"pH PAPERS"

Accurate ph values in a few seconds right at the tank.

These are the original "pH Papers" invented and produced by an outstanding German chemist. Guard against imitations using similar designations.

Indicator AND control-colors on SAME strip. Control-colors in steps of 0.2 pH and 0.3 pH.

Plating ranges
(200 strips of a range per box)

No.	Acid:	No.	Alkaline:
4862	(*4.8–6.2 pH)	6074	(6.0– 7.4 pH)
3650	(*3.6–5.0 pH)	6680	(6.6– 8.0 pH)
2439	(*2.4–3.9 pH)	7387	(7.3– 8.7 pH)
1028	(1.0–2.8 pH)	8610	(8.6–10.0 pH)
0414	(0.4–1.4 pH)	10113	(10.1–11.3 pH)
		11131	(11.0–13.1 pH)

*Electrometric Values in Nickel Solutions.

Each range is boxed separately

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E—1208. Spectroscope—Rapid chemical identification and analysis by direct, visual spectrochemical means is said to be possible through use of the Fuess metal spectroscope. The instrument proves ideal for sorting alloy types of steel, cast iron, brass, nickel, aluminum, magnesium, etc., as well as for checking analytical specifications of finished products, according to Applied Research Laboratories. Less than 60 seconds are required for a qualitative determination. Using a photometer attachment, a quantitative analysis, with an accuracy of 7 to 10 per cent of the concentration of the element, can be completed in a minute or two.

E—1209. In-Tank Filter—A new in-the-tank filter has been announced by Belke Manufacturing Co.

The complete assembly includes the filter unit, motor driven pump, and discharge hose. The filter unit hangs on the tank wall right in the plating solution.

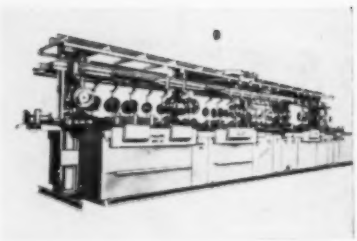
The motor driven pump, rated at 300 gal/min draws the plating solution through the filter unit and returns clarified solution to the plating tank. As many filter units may be used as required to provide the needed capacity. They are easily moved from tank to tank.

The standard filter bag is paper, which requires no pre-coat of filter aid for most solutions. To clean, the paper filter bag is merely removed and replaced with a new one.

Filter bags of dynel, vinyon, nylon or cotton twill can be furnished. To pre-coat these or the paper bags with filter aid or carbon, the pre-coat materials are mixed with water in any available drum. Operating the filter in the mixture pre-coats the filter bag; then filter unit and discharge hose are transferred to the plating tank without stopping the pump.

E—1210. Chromate Powder—Heatbath Corp. introduces a new chromate powder called Duracoat H-6-2 for producing iridescent golden chromate finishes on zinc and cadmium plate as well as on zinc die castings. Duracoat H-6-2 solution is made up using only 2–4 per cent Duracoat H-6-2 per gallon of water and requires no separate additions of other liquid acids for make up or during use. The iridescent golden chromate films produced are corrosion resistant and serve as bases for painting. Low cost, long life and ease of control are outstanding features of this new product.

E—1211. Plating Machine—Called the Meaker "Uniline", this new machine provides a continuous uninterrupted high speed operation that is said to produce high quality plating. With a high speed production capacity of 120 racks per hour, the Uniline handles the complete operation from cleaning to nickel and chrome plating. This new single row machine offers advantages such as complete reliability of operation, ease of maintenance and minimum space requirements.



Special carriers transport full rack load on steel rollers with permanently lubricated bearings.

E—1212. Remote Controlled Ultrasonic Generator—The Model APT-500 Sonogen generator, having a 3-kw average power output, is now available as a standard item from Branson Ultrasonic Corp. It is designed for high-volume, all day production cleaning, and will activate up to 6 sq ft of transducer area, or 300 gal of cleaning solution. The unit features motor tuning, twin oscillator construction and, for the first time, remote control.

The remote control panel connects to the Sonogen through a multi-conductor cable.

The KOCOUR SULFATE TEST SET with ELECTRIC CENTRIFUGE

. . . determines sulfate content in a chromium plating bath . . . directions are easy to follow . . . no calculations necessary . . . readings are directly in ounces per gallon.

● KOCOUR are specialists and pioneers in testing equipment for controlling plating — cleaning — pickling — anodizing — and hardening processes . . . special sets can be provided for your requirements.

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A concentrated liquid additive used at one part to 1,000 parts rinse water *eliminates* spotting out in copper and brass electroplating work.

. . . *Rinsing time cut up to 50%*
. . . *Work remains bright*
. . . *Successful Results Guaranteed*
. . . *Full refund if not satisfied*

Send your order today for one gallon trial $9.95. Five gallon cans @ $9.00 per gallon. 55 gallon drums @ $8.00 per gallon. F.O.B. Clark, New Jersey.

. . . Eliminates Spotting Out
. . . Successful Results Guaranteed

Order Today

AQUADYNE CORPORATION
CLARK, NEW JERSEY

PERSONALS

Merritt L. Smith has been appointed to the post of director of advertising and publicity for Metal & Thermit Corp.

In this position, Mr. Smith will have full responsibility for the operation of the company's advertising department and advertising and publicity agencies, and will develop an expanding public relations program.

Mr. Smith joined the Metal & Thermit organization in 1932 and in previous positions has been advertising manager, assistant sales manager, sales promotion manager and executive advisor.

He is a member of the National Industrial Advertisers Association, the National Sales Executives and the American Welding Society.

M. L. Smith

A. Korbelak

Alexander Korbelak has been made manager, marketing and new product development, Precious Metals Division, Sel-Rex Corporation, Nutley, N. J. Formerly sales manager of the division, Mr. Korbelak's new duties will include new applications and new market exploration for Sel-Rex's diversified line of precious metals electroplating processes for decorative and industrial applications. He will also work closely with the division's technical staff in the development of new products.

A graduate of Tufts College, Mr. Korbelak's background includes several years as an electrochemist with Seymour Manufacturing Co. where he contributed to the development of their bright nickel processes. He also spent eleven years with Westinghouse Electric Corp. in their electronic, chemical and metallurgical engineering departments.

Immediately prior to joining Sel-Rex in 1954, Mr. Korbelak was editor of PLATING magazine. The author of several papers on the techniques of electroplating difficult metals, he holds patents on pulsating plating techniques and metal processing.

R. Ziegeweid

C. Masek

Charles Masek and **Robert Ziegeweid** have recently joined Wyandotte Chemicals Corp., J. B. Ford Division, as sales representatives in the Division's industrial products department.

Mr. Masek, working out of Wyandotte's Cleveland, Ohio, district office, has a combined technical-service-sales background in the chemical and plating industries. His experience covers 15-years. He worked on water purification problems for the Atlas Powder Co., Ravenna, Ohio, for two years, and then went with the Addressograph Multigraph Co., Euclid, Ohio, for 12 years, becoming a plating foreman, and an assistant foreman of chemical manufacturing. His sales experience includes sales and service work with the Platers Supply Co. of Cleveland, Ohio and with a Cleveland chemical company.

He holds a Bachelor of Science degree in chemistry from John Carroll University and is a member of the American Electroplaters' Society.

Robert Ziegeweid is representing the J. B. Ford Division's Industrial Dept. in the Minneapolis, Minnesota area. He has been an industrial chemical representative for seven years.

T. S. Dewoody Jr. has been named to the newly-created position of manager—technical staff for the Electro Chemicals Division of Diamond Alkali Co., Cleveland, Ohio.

Mr. Dewoody joined the Diamond organization in 1947 as superintendent of its chlorine-caustic soda plant at Pine Bluff Arsenal. He held this position until April, 1958, when the Company terminated its lease with the government for operation of this facility.

A chemical engineering graduate of the University of Arkansas, he is a member of the American Institute of Chemical Engineers, Sigma Nu and Alpha Chi Sigma.

Dr. Hyman Chessin has received appointment as director of research and development for the Van der Horst Corp. of America.

Dr. Chessin was born in Cleveland, Ohio in 1920. Graduate work in electrodeposition and electrochemistry at Western Reserve University, Cleveland, Ohio led to the PhD degree in physical chemistry in 1951.

Teaching and research in electrodeposition at Kenyon College, Gambier, Ohio and research at the Institute of Science and Technology, University of Arkansas, Fayetteville, Arkansas was followed by the appointment in 1954 as assistant director of research for Van der Horst, Olean, New York.

L. Alderuccio

Dr. H. Chessin

Dr. Chessin is a member of the AES, the ACS, the Electrochemical Society, the Electrodepositors' Technical Society, London; Sigma Xi and Sigma Pi Sigma.

Lee Alderuccio has been named to the post of assistant director of research and development at Van der Horst. Mr. Alderuccio first joined the corporation in 1954 as a research electrochemist.

Arthur Phillips Jr. has been appointed vice president of Solvay Process Division, Allied Chemical Corp.

Also named to new posts are: **Verne W. Aubel Jr.**, to director of sales; **Robert L. Reynolds** who becomes assistant director of sales, and **G. Richard Barclay**, appointed manager of the sales department's Organic Chemicals Section.

Mr. Phillips, a graduate of Lafayette College, joined Solvay's sales force in 1929. Assigned to the Detroit sales branch, he was a salesman in that area until he entered the Navy in 1942. During World War II he took part in the invasion of Saipan and other Mariana Islands; and held the rank of lieutenant commander.

In 1946, Mr. Phillips was appointed manager of the Detroit sales branch. He

became assistant director of sales in 1954 and the following year was appointed director.

A graduate of Pennsylvania State College, Mr. Aubel was first employed by Solvay in 1939 as a salesman at the Philadelphia branch.

During World War II, Mr Aubel served in the Navy, attaining the rank of lieutenant. Since that time he has held positions including manager of the Philadelphia sales branch, and for the past year has been assistant director of sales.

Following his graduation from Brown University in 1940, Mr. Reynolds was employed by Solvay's technical service department. He joined the Chemical Division of the War Production Board in Washington, D.C. two years later and then entered the Navy, serving as an ammunition shipping officer. After the war, Mr. Reynolds became field sales representative at Solvay's Detroit and Philadelphia branch offices. Prior to his present assignment he had been manager of the sales department's Organic Chemicals Section.

Mr. Barclay, an Air Force Veteran, was employed by Solvay in 1950, after his graduation from the University of Toronto. Assigned to technical service at Syracuse, he moved to Detroit one year later as a salesman. Since last year, he has been assistant to the manager of Organic Chemicals Section. The new appointees will continue to be located at 61 Broadway, New York City.

Solon D. Fisher has been appointed assistant manager of the St. Louis sales branch, Solvay Process Division, Allied Chemical Corp.

Mr. Fisher holds a Bachelor of Science degree in chemical engineering from Kansas State College. He joined Solvay in 1948 and was assigned to the St. Louis branch as a salesman. In 1955 he was transferred to New York as technical assistant to the manager of what now is the Special Chemicals.

A veteran of World War II, Mr. Fisher served in the Chemical Warfare Service and continued with the Government as a civilian chemical engineer at the Edgewood Arsenal for a year subsequent to his discharge.

Walter F. Craig Jr. is now manager of metallurgical development of Climax Molybdenum Co., a division of American Metal Climax, Inc.

The newly-appointed engineering executive has been directly associated with metallurgical development since receiving his BS degree from Iowa State College in 1936. Before joining Climax he was supervisor of ferrous metals research for Armour Research Foundation and had also served as a research metallurgist for United States Steel Corp.

F. H. Havins

W. P. Alina

Felton H. Havins, a native of the Fort Worth-Dallas area, has been named director of sales engineering for Anadite, Inc. of Texas. Anadite is located in Hurst, Texas. Mr. Havins was formerly affiliated with North American Aviation, Luscombe, Chance Vought, and most recently chief project engineer of Brunswick-Balke-Callendar.

Walter P. Alina has joined RCA, Somerville, N. J., in the capacity of plating engineer in the Production Engineering Department. His duties will include the solving of plating problems, establishment of efficient work flow, setting plating standards, estimating plating costs and the determination of plating solutions and methods. He was formerly with Revlon Implement Corp., Security Steel Equipment Corp., Hermetic Steel Products Co. and Lionel Corp. He received a BS in chemistry from Seton Hall University and is presently studying metallurgy at Newark College of Engineering. Mr. Alina is an active member of the AES Newark Branch.

H. G. Bixby, president of Ex-Cell-O Corp., has accepted an appointment to the Board of Directors of Detrex Chemical Industries, Inc.

The 152-in.-long, 3-ton rotogravure cylinder above will be used to print patterns on vinyl-plastic floor coverings. National Gravure

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H. G. Bixby

E. R. Breining

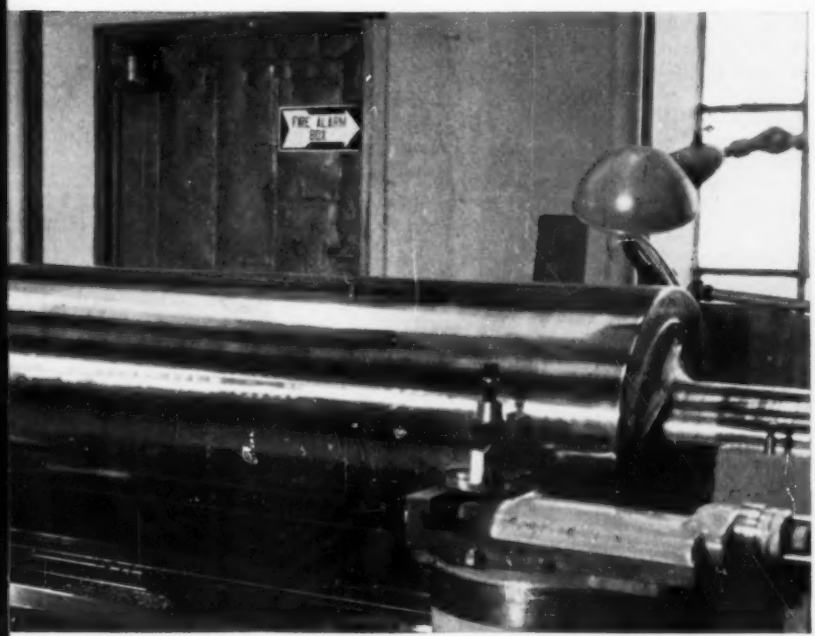
He is a director of nine other companies, including Michigan Chrome and Chemical Co., is Regional vice president and director of the NAM, and vice president and director of the Aero Club of Michigan. Mr. Bixby is a graduate of the University of Michigan.

E. R. Breining resigned Oct. 15 as manager of Gas Plating Laboratories, Commonwealth Engineering Co. of Ohio, to enter into business as a chemical consultant with office at 262 Liberty Street, Muir, Michigan.

Jerome J. Hargarten has been appointed service manager of the Chlorine Products Division for the Du Pont Co.'s electrochemicals department.

He will direct activities of solvents technical representatives here and will coordinate metal cleaning work in the field and at the new electrochemicals department's Sales Technical Laboratory at Chestnut Run.

Mr. Hargarten joined Du Pont in 1950 as a development engineer. He has held various technical positions, including technical service representative for chlorine products in the Detroit area.



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A. Sartor

D. Johnson

Don Johnson has been promoted to sales manager of Almco, Queen Products Division. He has managed the Detroit Branch operations the past three years, and before this was our district manager in the Illinois-Wisconsin area, and sales engineer in the Minnesota-Iowa-Missouri area, before the Chicago assignment. He will be located in Albert Lea, Minn.

Al Sartor has been named branch manager of Almco's Detroit Operation, servicing Michigan, Ohio, Indiana, and Western Pennsylvania. He has serviced the Michigan area as sales engineer for five years.

Bruce Hardin has received promotion by Almco to sales engineer of the Mich'gan area. He has served as sales co-ordinator the past year.

Henry B. Clark, general manager of Diamond Alkali's Soda Products Division for the past two and a half years, has been named director of sales, a newly created position. He will hold responsibility for management of the company's nine branch sales offices and administration of its market planning program.

To his new post Clark brings broad sales and general management experience, including 24 years' service with the Company. A Diamond sales representative in New Jersey for 12 years, he was manager of the firm's New York—New England Branch sales office from 1948 to 1956, when he was named general manager of the Soda Products Division.

John W. Mantz, general manager of the Silicate, Detergent, Calcium Division since its formation in June 1954, has become general manager of the Soda Products Division of Diamond Alkali.

These two divisions have been combined into a single unit, which will henceforth be known as the Soda Products Division.

Mr. Mantz, with a record of 30 years' experience on the production side of the alkali industry, joined Diamond in 1946 as assistant superintendent of the former Alkali Division at Painesville. Appointed industrial relations manager in 1948, he became assistant general manager of the Painesville plant in 1950 and was named general manager of the Silicate, Detergent, Calcium Division in 1954.

BRANCH NEWS

Total AES Branches U. S., Canada Australia, November 1, 1958—58.

BALTIMORE-WASHINGTON

Brenner Reports USSR Conference to Joint Meeting

The Baltimore-Washington Branch held its opening meeting of the 1958–59 season on Thursday, Oct. 16, at the National Bureau of Standards in Washington, D. C.

The meeting was a joint meeting with the Baltimore-Washington Branch of the Electrochemical Society.

The Electrochemical Society held a brief business meeting preceding the featured speaker and the AES held their business meeting following the speaker.

Dr. Abner Brenner of the National Bureau of Standards lectured on his recent visit to Moscow. In May 1958, Dr. Brenner attended a Conference on Corrosion and Protection of Metals which was held under the auspices of the USSR Council of Scientific and Engineering Societies. Dr. Brenner reported on the conference and also gave his personal impressions of Moscow and the Russian people. Approximately fifty minutes were devoted to the showing of three dimensional colored slides. Following Dr. Brenner's talk concerning his delightful experiences in Moscow, he showed colored slides he had taken on his return trip to this country. These slides included scenes in Copenhagen, Berlin, Rome, Geneva, Luzern, the Jungfrau in the Bernese Oberland and the World's Fair at Brussels.

One new member was elected.

Harold Scott and **Edward J. Roach** were elected as alternate delegates for 1958–1959.

Harold W. Scott
Secretary

BLUE RIDGE

Convention Exhibit Discussed; Haupt Talks on *p*H

The Blue Ridge Branch held its regular monthly meeting, Oct. 3, at the Hut restaurant near Martinsville, Va. **T. R. Boggess** presided.

Two new members were elected.

Question of an exhibit at the Convention was discussed and motion that we indicate desire was made and carried. The secretary was instructed to notify the Society, although no delegates were present to certify.

C. G. Haupt, chemist for the Norfolk and Western Railway, gave a continuation of his program of last June. A lecture-demonstration on *p*H was conducted. Highlights were the factors of *p*H in our everyday life and other processes besides plating. The use and care of *p*H meters was demonstrated and tips on better care were given and explained.

Carl A. Witherspoon
Secretary-Treasurer

BRIDGEPORT

Branch Bylaws Ready for Consideration; Kwasnik is Speaker

The regularly scheduled business meeting and educational session of the Bridgeport Branch was held in the main ballroom of the Hotel Barnum on Friday, Oct. 10. President **Michael Tamas** called the meeting to order. Thirty-eight members and guests were present.

Two membership applications were received and one new member was accepted.

Christmas Dinner Dance—**Frank Kalafus** reported that preliminaries for the Christmas Dinner Dance had been accomplished. **Joe Haas** reported a previously held meeting had approved the format of the proposed Branch bylaws. After a discussion, it was suggested that the proposals be submitted to the Branch for consideration at the January meeting.

The branch voted they would not exhibit at the national convention. The delegates were authorized to notify National Headquarters to that effect.

Allen Ferguson won the door prize.

Librarian **William Lindsay,** introduced our own **Ray Kwasnik** as the featured speaker of the evening. After a very interesting discourse on the importance of metal finishing in general and aluminum anodizing in particular in our general economy, Ray discussed both the technical and practical aspects attendant to the anodizing of aluminum. His discussion was followed by a lively question and answer period. A rising vote of thanks was tendered Ray.

Bob Parker
Secretary

BRITISH COLUMBIA

Tour Jet Airliner; AES Golden Anniversary Recognized

A special meeting on Oct. 20 at the Canadian Pacific Airlines, Vancouver Airport to which the ladies were invited had a total attendance of 41 members and guests.

President **Jim Lee,** expressed our thanks to Canadian Pacific Airlines for the very interesting tour through the Bristol Britannia jet prop airliner and through the hangar and maintenance shops.

This was a special meeting because of three different factors. First of all, it acknowledged the British Columbia Centennial Year. Second, it was planned as Branch recognition of the Golden Anniversary of the American Electroplaters' Society, and, last, but certainly not least, the ladies were invited to attend.

There is no doubt that everyone enjoyed himself immensely. The opportunity to examine at close hand this aircraft of such great size and modern design was greatly appreciated and I know from many comments that the chance to get up into the complex cockpit was valued as much by the men present as the tour through the kitchens (for the preparation of in-flight meals) was prized by the ladies. The trip wound up by a viewing of the maintenance and overhaul shops. After this main part of the program was completed, Canadian Pacific Airlines generously provided light refreshments which hit the spot.

After the refreshments, we continued with our regular meeting.

It was moved by **Gordon Smith** and seconded by **Walter Kellerman** that four new members be elected. The motion was carried by the general membership and we welcome these gentlemen to our ranks.

The question of printing the monthly notices was once again on the agenda, but discussion and decision were delayed for one month, at which time **Doug Armstrong** has offered to bring in the small printing machine which he has suggested might meet our requirements.

The recommendations of the committee formed to investigate suggestions for improved attendance and more efficient financing were not sufficiently advanced for consideration at this meeting. Chairman of the committee, **Ralph Wolloschuk,** promised that a written report giving definite recommendations would be submitted at the next meeting.

During discussion of the above subject, Ralph Wolloschuk made a motion that a per capita tax of $5 per year be levied. It was seconded by **Nelson Shepherd,** but was defeated by the general membership.

BRANCH SECRETARIES

Branch News is required of all Secretaries monthly by AES Bylaws. First of the month is Branch News deadline for next PLATING issue. Any items on hand on that date will be carried in that edition. Later arrivals will appear in the issue immediately following. In reporting talks given by speakers before the Branch, please give titles of the talks, the speakers' full identification and any other pertinent information of interest to other Branches and PLATING's broad readership.

Gordon Smith proposed that a charge of $1 per meal be made at the next General Meeting. This was seconded by **Walter Kellerman** and carried by the membership.

Walter Kellerman reported on the electroplating night school course. The attendance so far has not met the requirement of 15 pupils. Few of those who have come out are engaged in the electroplating industry. Unless a guaranteed 12 people turned out within the next couple of evenings, Walter felt that it would be necessary to discontinue the course. He felt also that the people who have attended should be asked to join our Branch of the AES. Gordon Smith volunteered to attend the next evening of night school and to talk to these people with this point in mind.

It was also agreed that all members should, by telephone or direct contact, endeavor to enroll immediately a few more pupils, in order to maintain the night school course this year.

The next item on the agenda was a discussion of the action that should be taken regarding members who have not as yet paid their dues after two notifications. It was decided that Gordon Smith and the secretary should contact these delinquent members by telephone and attempt to finalize this problem.

N. A. Shepherd
Secretary

BUFFALO

Campbell Presents Paper; Christmas Party Planned

The Buffalo Branch held its October meeting at the Moonbrook Country Club in Jamestown, N. Y., on Friday, Oct. 3.

After a delightful dinner and business session, **John Donaldson,** our Librarian, introduced **Dr. Ivor E. Campbell** of the Battelle Memorial Institute who spoke on the "Formation of Coatings of and for Refractory Metals".

The annual Christmas Party will be held Saturday, Dec. 20, at the Niagara Manor, 899 Niagara Falls Blvd., Buffalo, N. Y. **Roger Brown** is chairman of the Christmas Party Committee and will be assisted by **Fred Goeckel** and **Roy Laciura.**

The January meeting will be held the second Friday of the month instead of the usual first Friday. Our librarian is planning to hold another down-to-earth discussion on plating problems, techniques and developments which will be spearheaded by various members of the Branch. A similar meeting held last season proved highly successful.

The 5th Empire State Regional Meeting will be held April 11, 1959 at the Hotel Stuyvesant in Buffalo, N. Y.

CENTRAL MICHIGAN

Corrosion Studies Presented by Brown

Central Michigan Branch held its first dinner meeting and educational session of the 1958–59 season.

Dinner was served at 7 p.m. on Tuesday evening, October 7 at the Roosevelt Hotel in Lansing, Mich. to 30 members and guests.

Following the dinner, **Harry Anderson,** librarian, introduced the speaker for the educational session, **Dr. Henry Brown** of the Udylite Research Corp. Dr. Brown presented his subject "Corrosion Studies with Various Combinations of Nickel and Chromium Plate." The lecture was nicely augmented with well-chosen slides and charts. Evidence of the interest in Dr. Brown's findings was shown in the many questions and answers following the lecture.

A Board of Managers meeting was convened following the educational session.

Homer E. Welch
Second Vice President and Publicity Chairman

CHICAGO

Dow Discusses Chrome Plating

The regular meeting of the Chicago Branch was held at the Western Society

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of Engineers on Friday, Oct. 3. Seven new memberships were accepted to the Branch.

The guest speaker for the evening was **Ron Dow,** manager, technical service of Metal and Thermit Corp. Mr. Dow spoke on "Recent Developments in Chromium Plating". The speaker pointed out that the usual decorative chrome plate consists of many small microscopic cracks that were inherent in any chromium plating thicker than 1–2 millionths. Chromium plate in thicknesses from 1–2 millionths is crack free. Attempts to increase the thickness of the chromium plating only increased the size and number of cracks. However, in some applications, the cracks in the plate act as excellent oil reservoirs. These cracks in the finish defeated one of the purposes of plating: corrosion resistance.

Mr. Dow illustrated with slides, that bright crack-free chromium has more corrosion resistance than ordinary chromium plate. The salt spray test showed, with equal thicknesses copper, nickel and chrome, that ordinary chrome plate was badly corroded in 24 hours; while, the crack-free chrome plate showed several rust spots in 175 hours. The bright crack-free chromium process is easier to operate because it is self regulating. The throwing and covering powers of the bath are better—an important advantage on parts where there are recesses. To relieve stresses in chrome plate, a baking of several hours at 750F for several hours is required. Mr. Dow concluded that bright crack-free chromium process is a definite step forward to increase the corrosion protection of chrome plate finishes. A lively question and answer period followed and he was warmly thanked for his very informative talk.

Christopher Marzano
Publicity Chairman

CINCINNATI
Quality Control Discussed by Critchfield

The meeting was called to order by President **Helmich** with 26 members and guests present.

A new and a transferred member were accepted. **Donald Gusse's** resignation from the office of first vice president was accepted, but his resignation from the branch was tabled so that President Helmich would have time to ask Mr. Gusse to transfer his membership to the Baltimore-Washington Branch.

The Branch was polled to see whether it is interested in having a Branch exhibit at the Golden Jubilee Convention, this year in Detroit. The members decided to oppose a Branch exhibit this year, in view of the fact that there is an Industrial Finishing Exposition. It was decided to recommend that branch exhibits be held in a year when there is no exposition.

President Helmich announced that an election will be held at the November meeting to fill the office of second vice president. **Will Loveless** and **Ed Roof** form the nominating committee, and further nominations will be accepted from the floor prior to the election.

A motion was carried to transfer funds remaining in the convention account to the Branch treasury, with a separate accounting, and to hold this money one year.

Guests **Kenneth Bellinger** of Conversion Chemical Corp., Rockville, Conn., and **Joseph Jackson,** of R. O. Hull & Co., Inc., Dayton, Ohio, were introduced by **Ezra Blount.**

Leroy A. Critchfield of R. O. Hull & Co., Inc., spoke on "Quality Control in the Plating Room." Mr. Critchfield showed a series of slides that demonstrated how statistical quality control can aid the plater in securing better results and avoiding trouble. By using frequency distribution charts and graphs it is possible to show that the plating process is being operated properly and is producing the best results that are possible with the process being used. Mr. Critchfield concluded his talk with a series of slides showing various instruments and laboratory control methods used for quality control in plating.

David L. Kaplan
Secretary

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COLUMBUS

McGraw on Spray Painting

The regular monthly meeting of the Columbus Branch was held at Reebs Restaurant on Friday, Sept. 5.

The business meeting was called to order by President **Harry Moore.**

A new member was elected.

President Moore appointed **Hans Gernes** a junior member of the Tri-State Committee. The president is automatically CTC representative.

Librarian **Les McGraw** introduced the speaker of the evening, **Bob Perry,** of DeVilbiss Co. whose subject was "Making the Most of Spray Painting Methods." Mr. Perry gave an interesting talk on spray painting.

Following a question and answer session and a round of applause for the speaker, the meeting was adjourned.

Halvor Christianson

COLUMBUS

Hessler Speaks on Plating Wastes

The regular monthly meeting of the Columbus Branch was held at Battelle Memorial Institute on Friday, Oct. 3.

The business meeting was called to order by President **Harry Moore.**

A new member was elected.

The Columbus Branch voted that it is in favor of an exhibit at the National Convention but think it is a poor year to start it, the opinion was that it should be put off until 1960.

Librarian **Les McGraw** introduced the speaker of the evening, **James Hessler** of Industrial Filter and Pump Manufacturing Co. whose subject was "Handling Plating Room Wastes". Mr. Hessler gave a very interesting talk on waste plant theory and design.

A question and answer session period was followed by a round of applause for the speaker.

Halvor Christianson

DAYTON

Cadmium Embrittlement Presented by Cohen; Dalic Process Demonstrated

The regular October Dinner meeting was held Oct. 15 at Globe Industries, Inc., Dayton, Ohio.

Forty members and guests were present for the dinner and 6 additional came for the technical program.

Prior to the dinner, a tour of Globe Industries was made.

Delegates and alternates to the Supreme Society were elected. They are: **Fred Bauch, R. L. Ruleff** and **Jack Baker** as delegates and **Richard Wright, Bennie Cohen,** and **L. H. Hadlock** as alternates.

One new member was also elected.

Bennie Cohen was introduced and he presented a short talk on "Cadmium Embrittlement". Bennie is a senior project engineer at Wright Air Development Center, Wright Field.

Next, the main speaker for the evening was introduced. **P. H. Brotzman,** Ohio Metachemical Co., Cuyahoga Falls, Ohio presented a paper and demonstration on "Dalic Process-Selective Electroplating". In addition, we had the pleasure of meeting and listening to **H. Dennis Hughes,** a co-developer of the Dalic process. Mr. Hughes is from Manchester, England and just happened to be visiting this part of the country. The demonstration consisted of actual plating of many samples with various metals.

Refreshments after the meeting were through the courtesy of the Globe Industries.

R. M. Clinchens
Secretary

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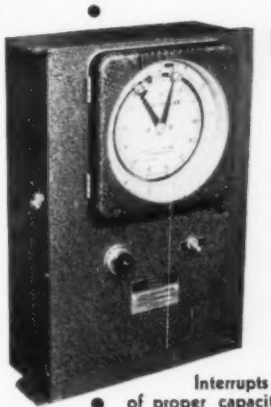

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DETROIT

Perez Speaks on Organic Coatings; Branch Handbook Available

Preceding the October monthly meeting of the Detroit Branch of the American Electroplaters' Society, **Manuel Ben,** president of the Detroit Branch, called an Executive Group meeting. In attendance at that meeting were: **John B. Hitchcock,** assistant secretary-treasurer; **Edward J. Kubis,** secretary-treasurer; **Donald M. Bigge,** first vice president; **Guy A. Cummings,** senior member, Board of Managers; **Cleveland F. Nixon,** delegate and chairman, long range planning; **Herberth E. Head,** national president; **Webster B. Knight; Fred E. Olmstead,** second vice president; **John F. Siefen,** Board of Managers; **E. L. Scholl,** chairman, plating lecture series: **Vincent J. Cassidy,** educational chairman; **Lee M. Morse,** alternate national delegate; **Myron Perez; Carl O. Durbin,** chairman, Christmas Party; **Robert C. Trees,** publicity chairman; **Manuel Ben,** president.

Ed Kubis reported that all delinquent members had been suspended and that notices had been sent to each member stating he would be reinstated with payment of dues.

Don Bigge reported that the Branch handbook would be out by Nov. 1 and that one copy would be sent to each member of the Detroit Branch. There would be a supply of these books available for purchase at 50 cents each.

Fred Olmstead reported on research procedures and problems and asked for the help of all members in selling our sustaining memberships. It is suggested that any members having any suggestions for the promotion of such sales contact Mr. Olmstead.

Carl Durbin reported on the December party stating that the letters to the Detroit Branch members would go out immediately and with each letter would be a requisition covering two tickets which the member can sign and send back with his check to secure his two tickets. This is the only means of distribution of the tickets with the exception of the few that will go to members outside of the Detroit Branch and dignitaries.

John Siefen reported on the successful handling of the Stag Day Party and the resulting small profit.

The branch meeting was attended by approximately 150. Myron Perez, of Metal and Thermit, spoke on the subject of "Organic Coatings over Plated Surfaces". Following the meeting, refreshments were served.

Robert C. Trees
Publicity Chairman

DETROIT BRANCH AUXILIARY

The Ladies Auxiliary, Detroit Branch, began a new year of meetings and activities in September. This year we are under the leadership of **Mrs. Guy Cummings** as president; **Mrs. Manuel Ben,** vice president; **Mrs. M. A. Fellows,** recording secretary; **Mrs. Charles Isackson,** corresponding secretary and **Miss Josephine Boatman,** treasurer.

The November meeting has as its guest speaker, **Mrs. Shirley Jones,** who will demonstrate the art of gift wrapping and bow making. Her program will center around Christmas gift packages. Previous programs this year have been on flower arranging and the care of modern synthetic fabrics.

Preparations are being made for entertaining the women who attend the 1959 Detroit Golden Jubilee International Exposition. **Mrs. Alice Pillsbury** is chairman of the ladies activities.

Mrs. John Drinkwater
Publicity Chairman

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Branch Past President Richard Watson Conducting Grand Rapids' Raffle.

GRAND RAPIDS

Ladies Night "Thoroughly Successful"

Oct. 11 was the occasion for the happily anticipated Annual Ladies Night for the Grand Rapids Branch. Seventy-two members brought their wives to the Louis XIV Room of the Manger Rowe Hotel for the gala occasion. The gals were treated to cocktails, a fine smorgasbord dinner, dancing and a wonderful social evening. Following dinner, Committee Chairman **Dick Watson** conducted the raffle of beautiful door prizes contributed by twenty-four generous vendors in the Grand Rapids area. Third National Vice President "Honest" **Chet Borlet** was unanimously approved to draw names while Committee Members **Don Smith, Carl Byrns** and **Tom Henner** distributed the prizes to the delighted wives. The dancing that followed was interrupted only by opportunities to renew old friendships. The Branch wishes to thank the Committee and suppliers for a thoroughly successful Ladies Night.

General Chairman Donald Smith announced that plans have been completed for the Grand Rapids Branch Annual Educational Session and Banquet to be held on Jan. 17, 1959. Educational Chairman **Orville Hoxie** has arranged a comprehensive program consisting of discussion of Hi-Speed Copper Plating by **Barnet Ostrow** of Lea-Ronal, beginning at 10:30 a.m. Luncheon will be served at noon and followed by a talk entitled, "Scientific Aids in Crime Detection" by Officer Karl Kempe of the Grand Rapids Police Crime Laboratory. The banquet will be held in the Pantlind Hotel Ballroom at 7 p.m. Reservations will be accepted by **John Dykstra** after Dec. 1. Other members of the Committee are: Entertainment, **Robert Blackford**; publicity, **Thomas Henner**; programs, **Edwin Krook**; and favors, **William Griffin.**

The Grand Rapids Branch would like to extend a cordial invitation to members and guests from all other Branches to attend.

Thomas C. Henner
Second Vice President

HAMILTON

Roosa Speaks on Phosphate Coatings

The Hamilton Branch of the American Electroplaters' Society held its first meeting of the 1958–59 season on Thursday night, Sept. 18, 1958. It was held at a new location at the Canadian Westinghouse War Vets Club, Hamilton, Ontario.

The meeting was called to order by President **John Edwards** and after the regular business, the meeting was turned over to **Ken Taylor** who introduced **M. B. Roosa** of the Parker Rust Proof Co., Rexdale, Ontario.

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Mr. Roosa spoke with authority on the subject of phosphate coatings which was of great interest to both the plater and our friends in the painting field. If Mr. Roosa is an example of what is to come in this season, we should have a full house at all our future meetings.

The speaker was thanked by **E. K. Cranfield** and the meeting was adjourned at 11 p.m. Refreshments were served through the courtesy of the Parker Rust Proof Co.

Don Darby
Reporting Secretary

HARTFORD

Cleaning Processes Explained by Haring

The regular Branch meeting was held at the Hotel Bond, Oct. 20, and 55 members and guests were present. Preceding the meeting a movie in color entitled "A Dawn's Early Light" was shown through the courtesy of the Westinghouse Corp.

The guest speaker for the evening was **David C. Haring** of the E. I. DuPont Co. whose subject was "How to Choose a Metal Cleaning Process".

Mr. Haring briefly mentioned various methods of cleaning such as alkaline cleaning (soak, spray, electrolytic), emulsion, vapor, wiping, dipping, acid descaling, dry or wet blasting, steam cleaning, etc. Two basic criteria are used for choosing a cleaning process. 1) Will it do the job you want done on the particular metals involved? 2) Surface contamination or the kind of soils involved as stamping, machining, drawing and quenching oils; polishing and buffing compounds, caked on oils and compounds.

Methods for figuring cost analysis data were presented and the advantages for vapor degreasing were shown as low utility requirements, compact high capacity equipment, low floor space requirements and cleaning cost is independent of the amount of soil.

The technical chairman for the evening was **Ralph McCahan.**

Stanley Platoz
Secretary

INDIANAPOLIS

Steurenagel Memory Honored; Square Dancing Enjoyed

Forty-eight members and guests of the Indianapolis Branch met on October 6, 1958, for a real Hoosier dinner in the heart of Hoosierdom at Abe Martin Lodge in Brown County State Park. This was the yearly meeting of the Branch as guests of the Columbus, Indiana members.

After the usual introductions, a short business meeting was held. Two new members were received by vote of acclamation.

A motion by **John Holland,** amended by **Dr. Max** and seconded by **Les Reynolds** placed the question of a Branch exhibit at the AES Convention in 1959 in the hands of the officers and Board of Managers. The motion was carried.

A moment of silence was observed at the request of **Bert Hawhee** for our recently departed member, **Marvin Steurenagel.**

The meeting was adjourned to enable the members and guests to watch an exhibition of square dancing and then to participate in the dancing. It was a very enjoyable evening.

A short meeting of the Board of Managers and officers was held after the business meeting to decide upon the matter of the Branch exhibit. The delegates were instructed to vote that the Branch would not exhibit.

A. M. Howard
Secretary

LOS ANGELES

Barrett Tells About Sulfamate Plating; Chairmen for Annual Party

The meeting was opened by President **Norman McEwan.** Seven guests were introduced by **Bill Heinike.**

The minutes of the June meeting were read and approved.

George Hetz introduced three men who were inducted into membership by President McEwan.

Barrie Blackburn reported that the research committee has moved forward this summer. Most of the sustaining members have renewed their subscriptions admirably.

Larry Henderson reported that the

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annual party and technical session is set for March 21, 1959 at the Beverly Hilton hotel. It will be a dinner dance with a lot of dancing time guaranteed. He named the committee chairmen: Banquet, **Bill Thomas;** Publicity and sale of tickets, **Don Bedwell;** Reservations, **Harold Wanamaker;** Educational, **Harvey Hunt.** Noon luncheon toastmaster—**Clare Ver West, Ozzie Gressat.** Door prizes, **Norman Painter.** There will be $500 to $600 worth of door prizes; but there will be only about six given, making the value of each prize high. The door prize committee will consist of **Vonna Ott, Claude Weekly** and one other to be named later. Larry Henderson has been authorized to raise the price of the ticket to $12 each. There will be entertainment —an ice show.

Don Bedwell reported for the committee to review election procedures. The committee recommended that a ballot box be set up 3 months prior to the election. The box to be used by the members to nominate candidates for office. The nomination committee will contact all nominees to determine their availability for office, and willingness to serve as an officer. Records to be kept of all nominees whether or not the nominee declines to serve. All willing nominees will be presented to the membership. The nominating committee can make further nominations. **Leo Missel** moved that the recommendations of the committee be accepted as an advisory procedure to the nominating committee. The motion carried.

Harvey Hunt introduced the speaker for the evening: **Richard C. Barrett** of Barrett Chemical Co., who gave a very interesting talk on sulfamate plating. Mr. Barrett covered sulfamate cadmium, nickel, iron and cobalt. He discussed the hydrogen embrittlement of various cadmium solutions and stated that the sulfamate bath produces practically no embrittlement. Mr. Barrett also revealed some interesting high temperature properties of the sulfamate nickel.

LOS ANGELES

Water Treatment Discussed by Wadleigh

The meeting was opened by President **Norman McEwan. Bill Heineke** introduced seven guests.

George Hetz introduced two who have petitioned for membership. One man was initiated into membership by President Norman McEwan.

George Hetz also reported on the progress of the 1960 Convention. Budgets are being prepared.

Mike Raskin announced the course in electroplating to be held at Woodbury College. Also a new course in Printed Circuitry.

An election was held for Delegates to the 1959 convention. Elected delegates are: Norman McEwan, George Hetz, **Emmett Babcock.** The alternates are: **Stu Krentel, Larry Henderson,** and **Earl Arnold.**

Larry Henderson reported on the annual party

Ed Wadleigh of Carma Manufacturing Co. was introduced as the speaker of the evening. He talked on 'Deionized Water". He told of various types of deionizers and water treatment equipment. He also dealt with the economics of deionized water.

LOUISVILLE

Ladies Night Celebrated

The monthly meeting of the Louisville Branch was held Oct. 16 at the Richmond Boat Club. This was the annual Ladies Night affair and there were 21 couples present for the dinner meeting.

President **Stanley Beyer** introduced all officers and committee members to the group and afterwards he presented Past President Buttons to **K. C. Reifsteck** and **John Houston.**

The Ladies were presented with a perfume assortment, **Mrs. Ken Buse** won

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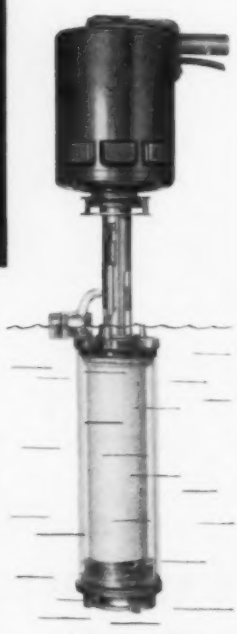

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A view of Louisville's fine party

the drawing for the floral centerpiece and **Mrs. "Bud" Schweri** won a gift certificate from a department store.

Following the drawings, **Leo A. Meagher,** managing director of the Louisville Better Business Bureau, presented a film and lecture on the purposes, functions, and charter of his organization. Our Librarian, Jim Smith, should be complimented on securing this speaker for Ladies Night since it is usually the housewife who is the victim of anti-better business practices and the film and subsequent discussion was enjoyed by all.

The meeting was followed by dancing in the club lounge.

Louis W. Dawson
Recording Secretary

MELBOURNE

Mrs. Coulson Speaks on Trouble Shooting

On July 17 at the Royal Melbourne Technical College, the 124th Regular Meeting was opened by President **John Christian,** 50 members and visitors being present.

After a short business session, Past President **Jim Parker** introduced **Mrs. W. Coulson,** our guest speaker from the Sydney Branch. Mrs. Coulson has had considerable experience in the electroplating industry both in the laboratory and the field. It was therefore appropriate that she should speak on the subject "Trouble Shooting in the Plating Shop".

Members were impressed by the logical and systematic approach with which Mrs. Coulson considered the possible sources of trouble under the headings of base metal, preparation cycle, plating solution, equipment and finally the human factor.

The discussion period covered many practical problems and, by the interest provoked, proved that platers can't keep out of trouble for long.

After a vote of thanks by **Herbert Littauer,** a most successful meeting was brought to a close.

Ian Rose
Secretary

MELBOURNE

Paper Presented on Ion Exchange; Top Student Awarded Prize

On Sept. 18, 32 members and visitors attended the 126th regular meeting at the Royal Melbourne Technical College under the chairmanship of **Lionel Esmore** who deputized for President **John Christian.**

A prize was presented to **Donald Blight** who was the outstanding student in electroplating for 1955 at the Collingwood Technical School.

John Dale introduced the guest speaker **S. E. Smith** who delivered an address on "Ion Exchange in the Plating Shop."

After discussing the various types of resins and the mechanisms of ion exchange, Mr. Smith described the applications of the process to electroplating—purification of water for solution make-up and for rinsing, treatment and recovery of rinse water effluents, and purification of plating and anodizing solutions.

After an interesting discussion, a vote of thanks was moved by **Ken Staggard.**

Ian Rose
Secretary

NEWARK

Gabel and Neidhammer Present Papers; Donroe Award Designated

The first Organic Finishing meeting of the Newark Branch was held on Oct. 24 with 65 present.

In the business meeting **Don Volino** was welcomed back to Newark, transferred from Philadelphia. Seven men were elected to membership. Four applications were received and referred to the Board of Managers.

Don Foulke announced the Philadelphia annual meeting.

Gus Bittrich congratulated **John Kosmos,** chairman of the Bylaws Committee and announced that copies of the Executive Committee-approved Bylaws were available for study and would be voted upon at the November meeting. **Fred Meyer** reported that the Christmas Party was well organized and asked that the Boosters reply promptly. **Cy LaManna** stated the Electroplating School was about ready to move into action and that only a few openings remained for registrants.

Gus Bittrich announced the award to the Branch member giving the best Timely Topic during the year had been designated the Louis Donroe Award.

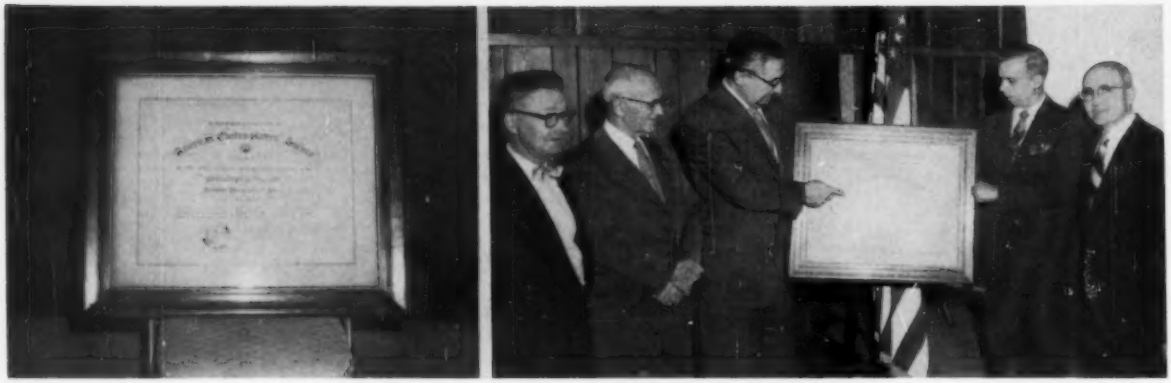
Don Foulke then spoke on the New Jersey water referendum and moved support. **John Banta** seconded and in support of the motion pointed out the need platers had for water. The motion passed.

George Wagner pointed out that some of the early Newark members were present: **Ed Faint, Sam Taylor** and **Dave Clarin,** now a New York Branch member.

The meeting was then turned over to Librarian **Al Korbelak** who introduced **E. LeRoy Gabel** of Allied Research Products, Inc., who discussed the use of the water soluble resin coating, Irilac, in which is incorporated corrosion inhibitors. This material may be used alone or to enhance post treatments such as phosphate and chromate conversion coatings. A number of slides were shown and it was explained that the concentration of the coating was maintained by a hexavalent chromium determination.

H. A. Neidhammer of DeVilbiss Co. then discussed "Hot Catalytic and Automatic Spray Painting". Types of equipment were described and various spray

In the spot light at the Annual Educational Session of Philadelphia Branch on Oct. 31. (Left) I. William Marcovitch, Dr. Samuel Heiman, John B. Winters, Dr. A. Kenneth Graham, Branch President Robert L. Farren Jr., Librarian Irvin K. Hauseman, National President Herberth E. Head, National First Vice President Ralph D. Wysong and Arthur W. Pierdon. (Right) Appreciative listeners applaud one of the speakers.



PHILADELPHIA BRANCH REPOSSESSES ITS CHARTER

A recent phone call from the University of Pennsylvania where the Philadelphia Branch formerly conducted its meetings informed the Branch that its framed AES charter had been found during a cleanup of an old storeroom. Forgotten for years, the framed charter was repossessed by the Branch in time for prominent display at its Annual Meeting, with Golden Jubilee background, held at the Sheraton Hotel, Philadelphia, October 31–November 1. Above (left) the charter; (right) Branch leaders viewing it, including (left to right) Branch Past President William H. Trusdell; Branch Treasurer Paul Mentzer; Branch Secretary I. William Marcovitch; Branch President Robert Farren Jr. and AES Past President Samuel Heiman.

guns discussed and exhibited, including the steam spray gun and the catalyst gun. Paint heaters on the heat exchanger system using hot water as the heat transfer material were said to have advantages in that the heat could be generated remote to the spraying operations. Automatic conveyor systems and pressure feed systems were noted as increasing in use.

D. Gardner Foulke
Secretary

PHILADELPHIA

Find Original Charter; Graham and Winters Speak

The annual Educational Session was held in the Sheraton Hotel on Friday, Oct. 31 and was opened by Branch President **Farren** at 7:40 p.m. About sixty members and guests attended. Due to no regular Branch meeting until Dec. 15, a short business session was held, with one application for membership approved.

The original framed charter of the Philadelphia Branch, the first Branch formed after the founding of the Society, was displayed in front of the speaker's table. The secretary told how it was recovered only during the current week after it had been lost for many years.

Session chairman **Dr. Samuel Heiman** introduced guests from other Branches, among whom were AES national officers. The first speaker was **Dr. A. Kenneth Graham,** Graham, Savage & Associates and prominent AES member, who accepted a last minute invitation to speak in place of **James F. Zievers,** who was ill. Dr. Graham spoke on electroplating engineering applications. He stated the improvement of quality of decorative/protective coatings was still a major problem and that poor quality may largely be due to inadequate specifications and/or failure to meet the specification. In contrast, he gave several examples of plating for engineering applications where rigid requirements, cost of the part to be plated necessitated the proper pre-plating preparations and closest process control. The results more than justified the planning and care.

The next speaker was **John B. Winters,** Incar, Inc., whose subject was "The Anode Side of the Story." With the use of some excellent slides, Mr. Winters gave an extremely interesting dissertation on the infrequently mentioned role of anode in plating. After describing some general anodic phenomena such as polarization and its effects on *p*H, voltage and current, stray anodic currents in unlined tanks and relatively simple methods to overcome them and the results of using anodes with different dissolution currents in the same tank, Mr. Winters discussed specific anode problems arising in cadmium, zinc, copper, nickel and lead anodes used in chromium plating. His talk contained a wealth of practical, every day, plating information that merits publication in its entirety as a paper.

A question period followed which showed the interest of the audience in both talks.

A film "Basic Electricity," produced by Walt Disney Studios in collaboration with the U. S. Air Force and Minneapolis-Honeywell, concluded the session.

The banquet, show and dance were held in the main ballroom of the Sheraton on Saturday, Nov. 1. They were preceded by a cocktail party sponsored by six prominent plating suppliers of Delaware Valley. The Saturday festivities were attended by 337, a great many of whom were still on hand when dancing stopped at 1:00 a.m.

The Philadelphia Branch is grateful to the many advertisers in the Banquet Program and to those who donated door prizes for their generous aid in making this a most enjoyable and successful affair.

I. Wm. Marcovitch
Secretary

NEW YORK

Trumbour Receives Honorary Membership

Dr. Edward Saubestre, president, presided over the closed meeting of Oct. 10 held at the Hotel Statler at which all the officers were present.

On behalf of the New York Branch, Dr. Saubestre bestowed to **John Trumbour** an honorary membership. John has been an untiring and outstanding servant to the New York Branch for many, many years. His achievements are overshadowed only by his modesty. When asked to say a few words after receiving this honor and a ring which was presented to him, all John could say was: "I hope I can be somewhere near as good a member as my father was."

Al Fusco voicing the recommendations of the Executive Board listed the following names for acceptance by the members as delegates to the next convention: **Angelo Amatore, Milton Nadel** and **Dr. Edward Saubestre.** These three were unanimously accepted as were the alternates: **George Herrmann, Joseph Rembecki, Arthur Carlson.** The chair was turned over to Librarian Arthur Carlson to conduct Good and Welfare.

Artie's choice for tonight was **Mr. Weisberg** of Technic, Inc., who discoursed on precious metal plating. Injecting some humor in his talk, Mr. Weisberg covered his subject well. He emphasized the lack of tolerance in "flash" solutions, which he referred to as starved solutions. The enthusiasm of the discussion session which followed was evidence that Mr. Weisberg had satisfied his listeners. He then

received a rising vote of thanks after which the meeting was adjourned.

Highlighting the meeting of September 26, 1958 was the re-nomination by the N. Y. Branch of Arthur Carlson and **Dr. Louis Weisberg** for the "Scientific Achievement Award".

Anthony P. Briganti
Recording Secretary

NEW YORK
Educational Session and Banquet

The New York Branch, which celebrates its fiftieth anniversary in 1959, will hold its annual Educational Session and Banquet on February 7, 1959 at the Hotel Statler in New York City.

A committee headed by Joseph Rembecki is planning a golden anniversary program to commemorate the event, which will include an expertly planned technical session and an unusually fine banquet and floor show.

Educational chairman Arthur Carlson has arranged the technical session. Topics for the afternoon educational program are:

"Copper-Nickel-Chromium Exposure Steel" by Walter Pinner, Manager, Electroplating Development, McGean Chemical Co., Cleveland, Ohio.

"Nickel Plating for the Last Fifty Years" by Dr. D. G. Foulke, Head of Research, Hanson-Van Winkle-Munning Co., Matawan, N. J.

"Corrosion Studies with Various Combinations of Nickel and Chromium Plate" by Dr. Henry Brown, Head of Research, Udylite Corp., Detroit, Mich.

Reservations for this gala event may be obtained by writing to Angelo Amatore, 9226 Foster Ave., Brooklyn 36, N. Y.

PITTSBURGH
Zievers Discusses High Speed Filtration

The second meeting of the Pittsburgh Branch for the 1958–59 season was held at the Gateway Plaza. The business meeting was attended by approximately 25 members and guests. The Branch elected two new members.

The guest speaker was **James Zievers,** of Industrial Filter and Pump Manufacturing Co. His most interesting topic was High Speed Filtration.

E. B. Keller
Secretary

ROCHESTER
Contribute to Research Fund; Mendell Speaks on Rectifiers

The October meeting was held at the Rochester German Club. The meeting was called to order by President **Frank Beuckman.**

Business matters discussed were: Approved sending $10 to AES Research Fund in the name of **Willis Fotheringham** of the Buffalo Branch who befriended the Rochester Branch on many, many occasions and will be greatly missed by the Rochester Branch as well as his now Buffalo Branch; approve suspending all members who have not paid dues by Oct. 15.

The speaker of the evening was introduced by Librarian **Ed Penczek. T. Mendell,** chief electrical engineer at Rapid Electric Co. gave an extremely interesting talk on rectifiers, their "innards" and their "outards." The various kinds of materials used in building rectifiers were discussed as well as types of controllers, ripple phenomena, etc. His talk and question-answering period well rewarded those members who came to this meeting.

Linwood P. Morrison
Secretary-Treasurer

ST. LOUIS
Julius Talks to His Own Branch

The first fall meeting of the St. Louis Branch was held Wednesday, Oct. 15 at the York Hotel with 28 people for dinner. The business meeting was called to order by President **William George** with 38 members and guests present. A new member was accepted on a motion by **Andy Julius,** seconded by **William Piel** and a unanimous vote. The following delegates and alternates were elected: Andy Julius, **Louis Berra,** William George—Alternates, **Craig McAlister, Henry Siegel, L. A. Davies.**

In answer to an inquiry whether the Branch desired to prepare an exhibit for the Golden Jubilee Convention a motion was made by Andy Julius and seconded by Louis Berra and passed that the St. Louis Branch not exhibit.

Ed Sertl, chairman of the Educational

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Committee, reported there were 22 students enrolled in the plating school.

A discussion was held relative to the St. Louis Branch joining the Midwest Regional. The bylaws were discussed particularly in regard to finances and withdrawal. Andy Julius pointed out that the next meeting would be the last Saturday in January in Chicago.

Librarian **Arthur Wrisberg** told us he has arranged to have **Dr. Henry Brown** of Udylite talk at the November meeting and have a plant tour of the National Rejectors plant in December. He introduced one of our own members Andy Julius of C. Hager & Sons Hinge Manufacturing Co., past president of St. Louis Branch, who talked on Brass and Bronze Plating. His talk was illustrated by charts showing *p*H curves and bath composition formulas. He exhibited much of the different kinds of finishes he is called upon to produce in large volume. He discussed how he solved spotting out and staining problems. The meeting was adjourned at 10:10 with a rising vote of thanks for Andy, one of the outstanding alloy platers in the country.

Ward Kelly
Secretary

SAN FRANCISCO

Missel Presents Paper;
Drive for Sustaining Members

Jack Hite, president, called our meeting to order at 8:30 p.m. **Fred Huntington** introduced our speaker, **Leo Missel,** who spoke on "Coatings for the Missile Industry." Mr. Missel discussed the various types of coatings that are now being used and pointed out the emphasis that must be placed on precision and quality plating and electroforming. He also pointed out the growing importance of beryllium in this field.

The regular business session followed and **Guy Condrett** reported that we had 33 members and 12 guests in attendance. This was the best turnout so far this year. As chairman of the membership committee, Guy also announced that four new applications for membership had been received. He again stressed the importance of securing sustaining memberships. The goal continues to be four memberships.

Fred Huntington reported on plans for the annual banquet. By vote it was agreed to hold the banquet at Goman's Gay Nineties on Nov. 22.

The following were elected as delegates to the National Convention: **Dominick Maviglia, Guy Condrett, Jack Esposito** —alternates: **Al Lee, Fred Huntington.**

Dominick Maviglia brought up the subject of securing AES buttons. The secretary was assigned to obtain prices and availability.

R. T. Coen
Secretary-Treasurer

SPRINGFIELD

Saltonstall Speaks on
Agitation in Electroplating

The Springfield Branch met at Blake's Restaurant, for the October meeting. A new member was elected.

Arthur Zavarella gave a brief review on an article from Iron Age Magazine. The subject was on Guided Missiles and Electronics. The review was well received by the group.

Melvin Roske, chairman of the Activities Committee, announced the plans for the 50th anniversary party and ladies night, which has been planned for Thursday, Dec. 4, at the Springfield Armory Officer's Club.

After the business meeting was completed, the balance of the evening was devoted to the technical session. Due to unavoidable absence of the Branch librarian, **Alexander R. Salmond,** his duties were taken over by **Robert J. Girard,** who after giving a brief background, introduced the speaker of the evening, **Dr. Richard B. Saltonstall,** technical director of Udylite Corp. of Detroit, Michigan. Dr. Saltonstall prefaced his paper with a commercial for attendance at the Golden Jubilee Convention in Detroit, next year. His subject for the evening was: The Role of Agitation in Electroplating. A goodly number of questions followed, and everyone agreed the subject was both timely and well covered. Thank you, Dr. Saltonstall!

Henry L. Heissfeld
Secretary

PLATING MAGAZINE
AMERICAN ELECTROPLATERS' SOCIETY

Opportunity to Authors

Member or non-member authors of technical and scientific papers on electroplating, metal finishing and related arts are cordially invited to submit manuscripts of original, unpublished papers to the Editor of PLATING for review and publishing consideration.

Any such paper accepted and published in PLATING will also be eligible, of course, for selection by the Society's Paper Awards Committee for the Carl E. Heussner Award; AES Silver Medal; AES Bronze Medal; George B. Hogaboom Memorial Award; Robert S. Leather Mechanical Finishing Award; Chromium Plating Award; Precious Metal Plating Award, or the John J. Hanney Memorial Award.

So as to expedite review and other processing, please write the Editor, PLATING, 445 Broad Street, Newark 2, New Jersey, for full particulars before submitting your manuscript.

TORONTO

Buffing Subject of McAleer Talk

The Toronto Branch held their October meeting on Friday the 10th, in the library of the Royal York Hotel. Thanksgiving week-end took its toll as only 19 sat down to dinner. Thirty-nine attended the business meeting, **Bob Edwards** presided, **Charles Hubbleday** reported on the successful fishing trip, **Mel Green** had some slides which proved very interesting. **Howard J. McAleer** of Formax Manufacturing Corp., Detroit, Michigan spoke to us on the subject "Polish Up Your Buffing Data." It was indeed a pleasure to listen to one so conversant with his subject and we congratulate you Howard for a very interesting and informative talk. The question period was well taken and the speaker was thanked by **Kergen Wells.**

A. W. Wilson
Librarian

WESTERN ONTARIO

Moores Discusses Reports On Quality Control

The Western Ontario Branch met on Oct. 17 at the Guildwood Inn, in Sarnia, Ontario. A fair representation of the Branch members was in attendance. **Art West,** general manager of Canadian Hanson and Van Winkle Co., **Ed Turner,** project engineer, and **Doug Hanna,** chief chemist, both of same company were guests.

The regular business was presided by **Dave Mainland,** president. The guest speaker, **E. Ross Moores,** assistant chief chemist, of Canadian Hanson and Van Winkle was introduced by **Jim Kelly,** librarian.

Mr. Moores gave a well-illustrated paper on "Some Aspects of Laboratory Reports on Quality Control". Portions of the talk were explained by slides, sample test panels and mimeographed sheets.

The speaker was thanked by **Les Crooks,** who in turn was given a vote of thanks by the members for a well-planned evening at Sarnia.

Leo Horodyski
Vice President

AES MEMBERSHIP REPORT

ELECTIONS

Baltimore-Washington: J. F. Kreml

Blue Ridge: B. Browder, L. C. Jackson

Bridgeport: J. Coyle

British Columbia: H. Eppich, J. Hofbauer, W. J. Marshall, H. A. Mroch

Buffalo: M. Stachura

Capitol District: B. L. Vondra

Central Michigan: C. L. Tyler

Chicago: A. W. Borggren, J. A. Cordes, R. A. Fox, C. A. Gosnell, B. Momme, E. A. Walden, J. White

Columbus: F. W. Marsh Jr., C. M. Tuttle

Dayton: D. B. Taintor, P. Ullery

Detroit: W. G. Anderson, P. R. Hendrixson

Hartford: J. J. Zapatka

Houston: J. E. Garrett

Los Angeles: S. A. Golnick, P. P. Schlocker, G. H. Stukkie

Melbourne: D. J. Blight, R. J. Graham, L. J. Houghton, L. P. Ilsley, G. A. Noy, D. L. Renehan

Montreal: W. F. Frewen, R. Paradis

Newark: T. Barreiro, F. X. Carlin, A. Chasmer, J. Connell, J. C. Gabriel, F. Kelly, C. Tringali

Philadelphia: N. G. Wallace

Pittsburgh: R. E. Fesser, W. A. Vitalie

Rockford: C. N. Lester, C. H. Page, D. J. Walsh

St. Louis: E. F. Sturm

Springfield: F. E. Chagnon, M. S. Spivak

Toronto: H. Van Broeck, L. E. Sterne

Twin City: G. Schedin

Western Ontario: E. Pauress

Member-at-Large: M. Acevedo C., Mexico 17, D. F., Mexico; G. M. Cowley, Leicestershire, England; E. F. Marlow, Warwickshire, England

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Melbourne: J. T. Chappell, D. W. Donaldson, J. N. Lynch, G. Partell, K. W. Peacock, R. D. Slade, O. B. Simon, R. D. Taylor

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Cleveland: Albert W. Abeling to Pittsburgh

Detroit: R. A. Brown to Chicago, F. R. MacKercher from Grand Rapids

Los Angeles: W. Pardee from Cleveland

Montreal: H. B. Baka from Toronto

Newark: R. Groom to Louisville, D. Volino from Philadelphia

Philadelphia: R. H. Schindler from Pittsburgh, D. P. Volino to Newark

Pittsburgh: R. H. Schindler to Philadelphia

Toronto: D. F. West to Western Ontario

Member-at-Large: K. Porter to Dallas-Ft. Worth

RESIGNATIONS

Bridgeport: H. W. Hammill

British Columbia: J. Vangolen, G. L. Young

Buffalo: H. H. Baker

Chicago: T. S. Burdge

Columbus: J. C. Weekley

Dayton: L. E. Michael, J. R. Blair

Los Angeles: W. A. Felker, J. M. Ghio, W. H. Stoddard

Melbourne: F. R. Richards

Montreal: H. Duffill, E. J. Patry

Philadelphia: J. J. Dougherty

St. Louis: R. W. Fournier, J. Hagerling, F. Kallus, L. Kumpf, J. Pauly, M. Unterberger

Toronto: H. Chapman

Twin City: T. Ballentine, W. D. Forbes, R. Smith, M. D. Swanson, J. M. Weller

SUSPENSIONS

Los Angeles: G. E. Boehmer

Rochester: D. Groh, J. Pullano, J. Pusey, R. Richard, P. Ronco, F. Tindale

St. Louis: A. Baldoni, J. W. Beane, H. L. Cissell, J. Delevenski, E. A. Epple, E. Hunleth, A. Hunning, N. A. Knicrnim, E. W. Kunish, T. A. Leonhardt, C. J. Lochhaas, E. Martin, Ingram Moore, F. W. Mosher, M. E. Nordman, P. Sarakas, J. Slater, W. Snow, A. Sommerville, F. W. Young

Syracuse: G. Brost, B. W. Dutter, I. Lynch, F. F. Mariano, I. Psyck, D. H. Robinson, W. Storms

Western Ontario: R. Cooper, W. Marko, J. Todd

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New York: T. Trumbour

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FUTURE MEETINGS

AMERICAN ELECTROPLATERS' SOCIETY

December 20—**Buffalo Branch,** Annual Christmas Party, Niagara Manor, Buffalo, N.Y.

January 17, 1959—**Grand Rapids Branch,** Annual Educational Session and Banquet, Pantlind Hotel, Grand Rapids, Mich.

January 23, 1959—**Editorial Board,** Hotel Statler Hilton, Detroit, Mich.

January 30, 1959—**Research Committee,** Conrad Hilton Hotel, Chicago, Ill.

January 31, 1959—**Chicago Branch,** Annual Meeting and Banquet, Conrad Hilton Hotel, Chicago, Ill.

January 31, 1959—**Cleveland Branch,** Annual Educational Session and Dinner-Dance, Hotel Carter, Cleveland, Ohio.

February 7, 1959—**New York Branch,** Annual Educational Session and Banquet, Hotel Statler Hilton, New York, N. Y.

February 13–14, 1959—**Dixie Regional Group,** Educational Session and Banquet, Southeastern Host Branch, Dinkler Plaza Hotel, Atlanta, Ga.

February 13–15, 1959—**Executive Board,** Dinkler Plaza Hotel, Atlanta, Ga.

February 14, 1959—**Sixth Interim Meeting,** Dixie Regional Group Sponsor, Southeastern Host Branch, Dinkler Plaza Hotel, Atlanta, Ga.

March 7, 1959—**Rockford Branch,** Annual Educational Session and Banquet, Faust Hotel, Rockford, Ill.

March 7, 1959—**Dayton Branch,** 13th Annual Meeting and Dinner-Dance, Dayton, Ohio.

March 20, 1959—**Editorial Board,** National Headquarters, Newark, N. J.

March 21, 1959—**Los Angeles Branch,** Annual Educational Session and Banquet, Beverly-Hilton Hotel, Los Angeles, Calif.

April 4, 1959—**Fifth Tri-State Regional,** Louisville Host Branch, Louisville, Ky.

April 11, 1959—**Baltimore-Washington Branch,** Annual Banquet and Dance, Presentation of Pot, Washington, D. C.

April 11, 1959—**Empire State Regional,** Buffalo Host Branch, Hotel Peter Stuyvesant, Buffalo, N. Y.

April 18, 1959—**Twentieth New England Regional,** Waterbury Host Branch, Hotel Statler, Hartford, Conn.

April 25, 1959—**Milwaukee Branch,** Annual Meeting and Banquet, Schroeder Hotel, Milwaukee, Wis.

FUTURE MEETINGS

(Continued)

May 2, 1959—**Boston Branch,** 23rd Annual Technical Session and Banquet, Hotel Statler, Boston, Mass.

June 15–19, 1959—**Golden Jubilee Convention and International Exposition, Including Fifth International Conference on Electrodeposition and Metal Finishing,** Convention Headquarters—Hotels Statler Hilton and Sheraton-Cadillac, Exposition—Artillery Armory, Detroit, Mich.

January 15–16, 1960—**2nd Annual Dixie Regional Technical Session,** Saxony Hotel, Miami Beach, Florida. Sponsored by Miami Branch with Blue Ridge and Southeastern participating.

July 10–14, 1960—**47th AES Annual Convention,** Hotel Statler, Los Angeles, Calif.

June 18–23, 1961—**48th AES Annual Convention,** Hotel Statler, Boston, Mass.

June 25–28, 1962—**49th AES Annual Convention,** Schroeder Hotel, Milwaukee, Wis. Sponsorship Midwest Regional Council.

June 24–27, 1963—**50th AES Annual Convention,** Ambassador Hotel, Atlantic City, N. J. Sponsorship Newark Branch.

INTERSOCIETY

January 27–30, 1959—**Society of Plastics Engineers,** 15th Annual Technical Conference, Hotel Commodore, New York, N.Y.

February 2–6, 1959—**American Society for Testing Materials,** Committee Week, Penn-Sheraton Hotel, Pittsburgh, Pa.

March 16–20, 1959—**11th Western Metal Exposition and Congress,** American Society for Metals and other technical groups, Pan-Pacific Auditorium and Ambassador Hotel, Los Angeles, Calif

March 17–19, 1959—**National Association of Corrosion Engineers,** 15th Annual Conference and Exhibition, Hotel Sherman, Chicago, Ill.

May 3–7, 1959—**The Electrochemical Society,** Spring Meeting, Sheraton Hotel, Philadelphia, Pa.

May 7, 1959—**Society of Plastic Engineers,** Regional Technical Conference. "Plastics and the Metals Industry," Penn-Sheraton Hotel, Pittsburgh, Pa.

May 16, 1959—**Masters' Electro-Plating Association of New York,** 41st Annual Banquet, Hotel Plaza, New York, N. Y.

June 21–26, 1959—**American Society for Testing Materials,** 62nd Annual Meeting, Hotel Chalfonte-Haddon Hall, Atlantic City, N. J.

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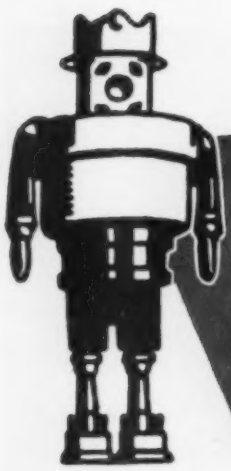

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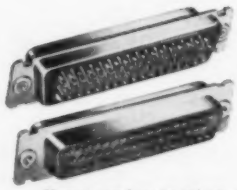

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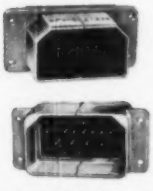

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